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JC662 U.S. PTO

**NON-PROVISIONAL  
UTILITY PATENT APPLICATION  
TRANSMITTAL - 37 CFR 1.53(b)**

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(check, if applicable)

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JC662 U.S. PTO

Assistant Commissioner for Patents  
**BOX PATENT APPLICATION**  
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Transmitted herewith for filing is the **non-provisional** utility patent application of inventors:

**Steven A. Bove, Ralph C. Wileczek and Jeanne Gill**

entitled:

**SYSTEM AND METHOD FOR AUTOMATING INVESTMENT PLANNING**

which is:

an ☒ Original; or

a ☐ Continuation, ☐ Divisional, or ☐ Continuation-in-part (CIP)  
of prior Application No. /, filed .

☐ This non-provisional patent application is based on Provisional Patent Application  
No. , filed .

Enclosed are:

- ☒ Specification (including Abstract) and claims: 145 pages.
- ☒ Newly executed Declaration (original).
- ☐ Copy of Declaration from prior application.
- ☐ Separate Power of Attorney (including 37 CFR 3.73(b) statement, if applicable).
- ☒ 29 sheets of drawings (informal) plus one copy.
- ☐ Microfiche computer program (Appendix).
- ☐ Nucleotide and/or Amino Acid Sequence Submission, including:
  - ☐ Computer readable copy ☐ Paper Copy ☐ Verified Statement.
- ☐ Under PTO-1595 cover sheet, an assignment of the invention.
- ☐ Certified copy of Application No. , filed , is filed:
  - ☐ herewith or ☐ in prior application .
- ☒ Information Disclosure Statement, PTO-1449, and cited references.
- ☐ Other:

The filing fee has been calculated as shown below:

			SMALL ENTITY			LARGE ENTITY	
CLAIMS	NO. FILED	NO. EXTRA	BASIC FEE: \$380.			BASIC FEE: \$760	
Total	58 -20 =	38	X9	\$	OR	X18	\$ 684
Independent	4 - 3=	1	X39	\$	OR	X78	\$ 78
Multiple Dependent Claims Present			\$130	\$	OR	\$260	\$
			<b>TOTAL</b>	<b>\$</b>	<b>OR</b>	<b>TOTAL</b>	<b>\$1,522</b>

The Commissioner is hereby authorized to charge payment of the following fees or credit any overpayment to Deposit Account No. 16-0235. One additional copy of this sheet is enclosed.

- ☒ The above calculated filing fee of **\$1,522.00**.
- ☒ Any additional fees required under 37 C.F.R. § 1.16.
- ☒ Any additional fees required under 37 C.F.R. §1.17.
- ☒ If the filing of any paper during the prosecution of this application requires an extension of time in order for the paper to be timely filed, applicant(s) hereby petition(s) for the appropriate extension of time pursuant to 37 C.F.R. §1.136(a).

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Enclosures

TITLE OF THE INVENTION  
SYSTEM AND METHOD FOR AUTOMATING INVESTMENT PLANNING

BACKGROUND OF THE INVENTION

5       The present invention relates to automated investment planning, particularly to systems and methods which automatically generate financial transaction recommendations for modifying a client's current asset portfolio to reach as close as possible to a desired asset allocation and asset placement (i.e., preferred domain).

10       Personal investment planning is a complex process. Accordingly, many software products have been developed to assist individual investors, investment counselors and investment professionals in the process. Software products have been developed to select the appropriate asset allocation and portfolio of assets within each asset class. A properly managed investment portfolio must be periodically rebalanced either to maintain the investor's desired allocation or to modify the current allocation to a different allocation if the needs of the investor changes. In the rebalancing process, specific assets are bought and/or sold.

15       The rebalancing process is conceptually simple. For example, if an investor's portfolio becomes too heavily weighted in equities and not sufficiently weighted in bonds for the desired asset allocation, then some stock assets are sold and some bond assets are purchased. However, the problem is deciding which stock assets to sell and which bond assets to purchase. Ideally, the investor would like to rebalance the portfolio without incurring any tax implications or transaction costs. However, selling stock assets almost always has tax implications, and any buying and selling of assets incurs transaction costs which immediately decrease the total assets of the investor. Thus, it is not necessarily beneficial to fully reach the desired asset allocation if doing so would incur excessive transaction costs and/or significant negative tax implications.

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5 The conventional process of evaluating an investor's asset portfolio for  
rebalancing is a very labor intensive process even when assisted by a software program.  
Furthermore, even an experienced investment counselor cannot mentally sort through all  
of the factors to be considered in the rebalancing process so as to identify the best assets  
to buy and sell.

10 Despite the sophistication of conventional investment planning tools, there is still  
an unmet need for a rebalancing tool which automatically generates transaction  
recommendations that take into account an investor's desired asset allocation, as well as  
the investor's preferred domain, while minimizing tax implications and transaction costs.  
The present invention fulfills such a need.

#### BRIEF SUMMARY OF THE PRESENT INVENTION

15 One embodiment of the present invention provides a computerized scheme for  
automating investment planning for a client. In the scheme, data regarding the client's  
desired asset allocation (also referred to herein as the "strategic asset allocation" or SAA),  
current asset portfolio and preferred domain (also referred to herein as "asset placement")  
are input into a computer or processor. This data are used to automatically generate  
financial transaction recommendations for modifying the client's current asset portfolio to  
reach as close as possible to the desired asset allocation and the preferred domain. The  
recommendations include specific recommendations for selling amounts of selected  
20 current assets and specific recommendations for buying amounts of one or more  
investment funds. The recommendations are displayed on a summary report for review  
by the client or the client's financial manager. Alternatively, the recommendations are  
used to sell amounts of selected current assets or to buy amounts of one or more  
investment funds. In the alternative embodiment, the recommendations may be  
25 electronically communicated to a trade execution computer which automatically performs  
the necessary transactions to execute the buy/sell recommendations. The  
recommendations may suggest that the client add specific amounts of shares to currently



held mutual funds, and/or open one or more new mutual funds and contribute specific amounts of shares to the new funds.

The recommendations are selected in a manner which minimizes the tax impacts and transaction costs of potential sell transactions, and the summary report includes the tax impacts and transaction costs of at least some of the recommendations.

In the scheme, the computer also receives data regarding the client's asset portfolio preferences, including current assets that the client wishes to hold or sell, any constraints on asset selling, and the client's Ibbotson score, and this data are also used to automatically generate the financial transaction recommendations. Target portfolio amounts and adjusted target portfolio amounts are developed for each asset category in the desired asset allocation.

The client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets. The scheme recommends holding the client's possibly repositionable assets if the client's new asset allocation will be within a predetermined percentage of the desired asset allocation, such as 3%, after selling all of the client's repositionable assets. The scheme may also treat possibly repositionable assets as non-repositionable assets when making the current asset portfolio modifications. Furthermore, the scheme may also recommend selling the client's repositionable assets until the tax cost of selling equals a predetermined percentage of the client's current asset portfolio.

The present invention also provides a computer program product including at least one computer readable medium having computer program logic recorded thereon for automating investment planning for a client in accordance with the scheme described above.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The following detailed description of preferred embodiments of the present invention would be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the present invention, there is shown in the

drawings embodiments which are presently preferred. However, the present invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

Fig. 1 is an investment asset hierarchy for use in the present invention;

Fig. 2A and 2B show sample portfolio allocations used in explaining Part I of the disclosure below;

Figs 3A through 3E are client questionnaire input screens;

Fig. 4 is a screen used to initiate analysis and report creation;

Fig. 5 is a screen used to specify funds which should be added to the client's proposed portfolio;

Fig. 6 is a worksheet screen for specifying buy/sell amounts;

Fig. 7 shows additional sample portfolio allocations used in explaining Part II of the disclosure below;

Figs. 8A through Figs. 8H, taken together, provide a detailed, functional data flowchart of the present invention;

Figs. 9A through 9H show class diagrams for all of the objects used in the present invention; and

Fig. 10 is a generalized schematic block diagram of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

Certain terminology is used herein for convenience only and is not to be taken as a limitation on the present invention. In the drawings, the same reference letters are employed for designating the same elements throughout the several figures.

The present invention is described in the context of one or more software programs, collectively referred to as a "computer program product," for automatic rebalancing of assets. The phrase "Auto Rebal" is also used to refer to the automatic rebalancing process. The computer program product resides in one or more computer readable media having the computer logic recorded thereon, such as a magnetic or optical disk, RAM, ROM, or the like. The computer program product may be executed on any general purpose computer. When executed, the computer program product performs the

functions provided by the computer program logic (i.e., software code) associated therewith.

The executed computer program product accepts input data regarding the investors, interchangeably referred to hereafter as "clients" or "customers," and provides outputs in the form of recommendations on a summary report or in the form of signals which execute automated buy/sell trades based on recommendations determined by the program. The client may interact with the executed computer program product directly, or a financial counselor may provide the inputs on behalf of the client. The description of the invention set forth below presumes that a counselor will interact with a client to provide all of the necessary input data.

Since the entire process occurs in a computerized and automated environment, the client, the computer program product, and the financial counselor (if used), may reside in the same physical location or each may be remote from one another and may communicate with each other by any suitable communication media. Furthermore, one or more portions of the computer program product may be remote from the general purpose computer which executes its software code. The present invention is thus best viewed as an automated financial service wherein the steps which are performed to provide the service and the associated physical hardware and software for performing the steps may be physically centralized or distributed in any suitable manner. The present invention may be implemented by any suitable combination of software and hardware.

The present invention is further described in the context of an automated financial service provided by a mutual fund entity, particularly, The Vanguard Group, Valley Forge, PA. Thus, the examples provided herein which illustrate one embodiment of the present invention refer to specific Vanguard funds by their well-known fund names. The use of Vanguard funds to illustrate the invention is not intended to limit the scope of the invention in any manner. For example, most large, diversified mutual fund companies manage funds which have similar investment objectives as the funds described in the examples. Also, the funds described in the examples may be replaced with funds from a plurality of different mutual fund companies.

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The example of the Vanguard automatic rebalancing process is explained in multiple parts, as follows:

PART I - Explains types of assets which are manipulated, provides sample portfolio asset allocations, shows sample client input screens and provides sample output report screens

5 PART II - Explains the logic behind the entire process in accordance with the disclosed embodiment of the present invention.

PART III - Provides detailed, functional data flowcharts and class diagrams for the disclosed embodiment of the present invention.

10 APPENDIX - Provides a linear programming version of the disclosed embodiment of the present invention.

Fig. 1 is a self-explanatory investment asset hierarchy which is necessary to understand the process. References are made to the asset hierarchy throughout the disclosure below.

15 Fig. 2A shows seven sample taxable portfolio allocations, and Fig. 2B shows six sample non-taxable portfolio allocations.

## PART I.

### AUTO-REBAL SALES AND PURCHASES

Step 1 - Auto-Rebal sells repositionable assets and proceeds are put in a "money market" on a per registration basis.

- 20
- a. Non-Vanguard non-repositionable assets are never sold
  - b. Non-Vanguard repositionable assets are always sold
  - c. Vanguard non-repositionable assets are never sold
  - d. Vanguard repositionable assets may or may not be sold

25 Example: A client needs \$100,000 of Windsor II. Preferred domain says we need municipals in taxable accounts. The client has \$100,000 of Windsor II in a taxable account. Auto-Rebal will recognize that Windsor II should be kept.

Step 2 - Auto-Rebal determines strategic asset allocation and sub-asset allocation by comparing the target portfolio amounts against what is non-repositionable. The greater of the non-repositionable amount or the target amount will be used as the proposed amount.

Step 3 - Auto-Rebal makes purchases

5 Auto-Rebal will make purchases in the following order:

1<sup>st</sup> - Stocks will be purchased into a Roth IRA if available.

2<sup>nd</sup> - Stocks will be purchased into an annuity if available.

3<sup>rd</sup> - Preferred domain rules are initiated.

a. If the client is in the 39.6% MTB, bonds will be bought first every time.

10 b. If the client is not in the 39.6% tax bracket and the income stage is checked, bonds will be bought first.

c. If the client is not in the 39.6% tax bracket and the accumulative stage is checked, stocks will be bought first.

15 4<sup>th</sup> - Taxable accounts are used to buy stocks or bonds based on the above preferred domain rules until no taxable money is left. If additional purchases are required they will be made in retirement plans.

5<sup>th</sup> - Purchases are made in retirement accounts (other than Roth IRAs and annuities).

a. Restricted plans (i.e., limited fund choices) are used first.

20 b. Non-restricted plans are used next. (If a system limitation exists, restricted plans are used last. This may cause a purchase to be made in a less than optimal fund and may require a manual adjustment. For an example, see Auto Rebal Work Arounds.)

25 When making purchases, Auto-Rebal will follow the stocks out bonds in hierarchy or the bonds out stocks in hierarchy, as described below. Purchases are made from the accounts with the largest dollar balance first (based on the above), to minimize the duplication of funds.

## I. STOCK OUTSIDE HIERARCHY

1. Large Index Purchases (50% of large)
2. Mid/Small Index (50% of mid/small)
3. Growth Exposure (25% of large)
4. Value Exposure (25% of large)
5. Active Mid Cap Exposure (25% of mid/small)
6. Active Small Cap Exposure (25% of mid/small)
7. International Developed
8. International Emerging

## II. STOCK INSIDE HIERARCHY

1. International Developed
2. International Emerging
3. Active Small Cap Exposure (25% of mid/small)
4. Active Mid Cap Exposure (25% of mid/small)
5. Value Exposure (25% of large)
6. Growth Exposure (25% of large)
7. Mid/Small Cap Index Exposure (50% of mid/small)
8. Large Index Exposure (50% of large)

## III. BONDS OUTSIDE HIERARCHY

Municipal or Corporate Bonds will be purchased based on a client's tax bracket.

The category order is illustrated below:

### A. Long-term Bond Exposure

1. Corporate and Treasury, or
2. Municipal

### B. High-Yield Bond Exposure

1. Corporate, or
2. Municipal

### C. Intermediate-Term Bond Exposure

1. Corporate and Treasury, or
2. Municipal
- D. Short-term Bond Exposure
  1. Corporate and Treasury, or
  2. Municipal

5

#### IV. BONDS INSIDE HIERARCHY

- A. Short-term Bond Exposure
  1. Corporate and Treasury
- B. Intermediate-Term Exposure
  1. Corporate and Treasury
- C. High-Yield Exposure
  1. Corporate
- D. Long-term Exposure
  1. Corporate and Treasury

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#### NEW ASSET CLASSES

- A. Stocks
  1. Large Cap
    - a. Index
    - b. Active
      1. Growth
      2. Value
      3. Market
  2. Mid Cap
    - a. Index
    - b. Active
  3. Small Cap
    - a. Index

20

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b. Active

B. Bonds (across the yield curve)

1. Corporate
2. Treasury
3. Mortgage

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VANGUARD FUND CHOICES (Core Portfolio)

Auto-Rebal will always purchase the preferred fund if any of the following conditions apply:

1. The client has no funds in the asset class.
2. The preferred fund is owned in isolation.
3. The preferred fund is owned along with an alternate fund in the same registration.

10

Auto-Rebal will purchase the alternate fund if:

1. It is the only fund owned in the asset class.
2. If the preferred and alternate fund are owned in different registrations and preferred domain requires a purchase of the alternate fund.
3. If it is the only available fund in the restricted plan.

15

For bonds, Auto-Rebal will attempt to use corporate and index funds whenever possible. If not possible, corporate and treasury funds will be used to achieve the appropriate corporate/treasury mix based on the portfolio in question. The "Alternate Funds" referred to below are not listed in order of preference.

20

I. STOCKS

A. Large

1. Index

a. Preferred - 500 Portfolio

b. Alternate - Growth and Income, Trustees' Equity and

25



Tax-Managed Growth & Income

2. Growth

- a. Preferred - U.S. Growth
- b. Alternate - Morgan Growth and Index Growth

3. Value

- a. Preferred - Windsor II
- b. Alternate - Equity Income and Index Value

B. U.S. Total Stock Market (to be used when large market/index to mid/small market/index equals 70/30)

- 1. Preferred - Total Stock Market
- 2. Alternate - Tax-Managed Capital Appreciation

C. Mid/Small U.S. Stocks

1. Index

- a. Preferred - Extended Market
  - b. Alternate - Index Small Cap
2. Mid Cap Active
- a. Preferred - Horizon - Aggressive Growth
  - b. Alternate - Primecap, Selected Value, Horizon - Capital Opportunity, Windsor

3. Small Cap Active

- a. Preferred - Explorer
- b. Alternate - None

D. International Stocks

1. Developed

- a. Preferred - European and Pacific
- b. Alternate - None

2. Emerging

- a. Preferred - Emerging Markets Index
- b. Alternate - None
- 3. Total International
  - a. Preferred - European Index and Pacific Index
  - b. Alternate - International Growth and Trustees' International

## II. BONDS

### A. High Yield

- 1. Municipal
  - a. Preferred - High Yield Muni
  - b. Alternate - None
- 2. Corporate
  - a. Preferred - High Yield Corporate
  - b. Alternate - None

### B. Long-term

- 1. Municipal
  - a. Preferred - Insured Long-term Muni or State specific Muni or State specific Muni if available
  - b. Alternate - Long-term Muni
- 2. Taxable
  - a. Preferred - Long-term Bond Index
  - b. Alternate - Long-term Corporate and Admiral Long-term U.S. Treasury or Long-term U.S. Treasury

### C. Intermediate-Term

- 1. Municipal
  - a. Preferred - Intermediate-Term Muni or State specific Muni
  - b. Alternate - None
- 2. Taxable
  - a. Preferred - Intermediate-Term Bond Index and Intermediate-Term

Corporate

- b. Alternate - Intermediate-Term Corporate and Admiral Intermediate-Term U.S. Treasury or Intermediate-Term U.S. Treasury

D. Short-term

1. Municipal

- a. Preferred - Short-term Muni (Portfolio 1) and Limited-Term and Muni (Portfolio 2 - 7)
- b. Alternate - Limited-Term Muni (Portfolio 1) and Short-term Muni (Portfolio 2 - 7)

2. Taxable

- a. Preferred - Short-term Corporate and Short-term Bond Index
- b. Alternate - Short-term Corporate and Short-term Admiral U.S. Treasury or Short-term U.S. Treasury

VANGUARD FUND CHOICES (Annuity)

I. Stocks

A. Large U.S. Stocks

1. Index

- a. Preferred - Equity Index
- b. Alternate - None

2. Growth

- a. Preferred - Growth Portfolio
- b. Alternate - None

3. Value

- a. Preferred - Equity Income and Diversified Value
- b. Alternate - None

B. Mid/Small U.S. Stocks

1. Mid Cap Index

- a. Preferred - Mid Cap Index
- b. Alternate - None
- 2. Small Cap Active
  - a. Preferred - Small Company Growth
  - b. Alternate - None
- D. International Stocks
  - 1. Developed and Emerging
    - a. Preferred - International
    - b. Alternate - None

5

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## II. Bonds

### A. High Yield

- 1. Corporate
  - a. Preferred - High Yield Bond
  - b. Alternate - None

15

### B. Intermediate-Term

- 1. Taxable
  - a. Preferred - High Grade Bond Index
  - b. Alternate - None

### C. Short-Term

20

- 1. Corporate
  - a. Preferred - Short-Term Corporate
  - b. Alternate - None

## AUTO REBAL SUMMARY

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After auto-rebal has produced a report, a summary is made of its conclusions. This will allow the counselor and reviewer to get an overview of the client's situation. The following is a prototype of the document and its contents:

## SAA Summary:

"The client reached the target SAA and the sub-SAA," or

"The client reached the target SAA but was off in the following sub-categories  
(list the sub-asset categories where proposed does not equal target)," or

5 "The client did not reach the target SAA and was off in the following sub-  
categories (list the asset and sub-asset categories where proposed does not equal  
target)."

## Indexing Summary:

### Stock Indexing:

10 Current = \_\_%  
Proposed = \_\_%  
Target = \_\_%

### Stock Active:

15 Current = \_\_%  
Proposed = \_\_%  
Target = \_\_%

## Growth vs. Value Summary:

### Growth Stocks:

20 Current = \_\_%  
Proposed = \_\_%  
Target = \_\_%

### Value Stocks:

25 Current = \_\_%  
Proposed = \_\_%  
Target = \_\_%

Tax Cost Summary:

Total Tax Cost = \$ \_\_\_\_

Tax Cost as a percent of portfolio = \_\_\_\_%

Transaction Summary:

5 Total Number of Steps = \_\_\_\_

Total Number of Transactions = \_\_\_\_

Fund Summary:

Preferred Funds:

The following preferred funds were not used: (list funds)

10 Alternate Funds:

The following alternate funds were used: (list funds)

Income Summary:

Client Income Need = \$ \_\_\_\_

Taxable Bond Funds Generate = \$ \_\_\_\_

15 Surplus or Deficit = \$ \_\_\_\_

Preferred Domain Summary:

Client is an income investor or an accumulation investor or in the 39.6% MTB

Stocks or Bonds should be outside

Taxable Accounts:

20 Stocks = \_\_\_\_%

Bonds = \_\_\_\_%

Cash Reserves = \_\_\_\_%

Tax-Deferred Accounts: (This includes Roth IRA's and annuities which may differ from preferred domain.)



This screen is modified to provide entry of state code from a drop down list of valid state codes. This will insure that the value entered will be a valid state code.

## EMPLOYMENT AND TAX INFORMATION

Fig. 3B is a questionnaire screen for entering additional core data regarding the client's employment and tax information. The following new fields were added to the PFP Questionnaire support the Auto Rebalancing project:

1. Current Year Gain
2. Carry Forward Loss

Current Year Gain - This field is used to input a gain that will be included in the total cost calculation used by auto rebal in determining whether to sell a "maybe" asset. This gain amount could be the result of customer activity outside the rebalancing process or it could be the gains resulting from previous rebalancing activity during the year. The default is zero.

Carry Forward Loss - This field is used to input a loss that will be included in the total cost calculation used by auto rebal in determining whether to sell a "maybe" asset. A loss amount can be used to offset gains from the sale of assets. The default is zero.

## INVESTMENT ASSETS

Fig. 3C is a questionnaire screen for entering additional core data regarding the client's investment assets. The Investment Assets screen is used to supply information on the client's current non-retirement investment holdings. There were no changes are being made to this screen compared to the conventional PFP screen.

An additional change will be needed when Auto Rebalancing is implemented for PAS. A new field will be needed to allow the PAS counselor to identify whether an asset should be included in the rebalancing process.

Fig. 3D is a questionnaire screen for entering additional core data regarding the client's current retirement plan holdings. This screen was modified for Auto Rebalancing to allow the counselor to do the following:



(1) Identify the plan to which assets in the existing plan should be moved during rebalancing.

(2) Indicate whether the plan has restricted assets.

(3) If investment alternatives are restricted, what assets are available as investment alternatives.

The following are new fields which are added to the screen:

(1) Repo Plan - This field contains 3 choices: Repo within same plan type, Repo to a new plan type, Do not reposition. If the Repo to a new plan type is selected, the system will determine the destination plan type based on the source plan type. The system will then look to see if there is already a plan of that type for the client. If there is, assets from the original plan will be added to the first plan for the new type plan. If there is not an existing plan of the new type for the client, the system will create a new plan for the purposes of buying assets with the proceeds of the original plan.

(2) Restricted Funds - This is a check box used to indicate whether or not the investment choices for this plan are limited. This box will only be available when reposition within the plan is specified in Repo Plan. If the box is checked, investment options for the plan are restricted; the Plan Name drop down list will then be functional.

(3) Plan Name, Plan Type and Last Update - These fields will only be available when Restricted Funds is checked. These are drop down list boxes showing the associated plan descriptions for which available funds have been defined. The counselor would select the correct Plan Name. The Plan Type (Annuity, 401(K), etc.) is a display only field which will show the plan type of the selected company/plan combination. The last update field will show the date of the last time this plan has been updated.

If the proper plan is not available, the counselor would need to obtain the available investment options from the client and have this information entered into the system via the Master Plan Maintenance mechanism before the plan could be completed.

The following new button was added to the screen to enable the counselor to review the investment choices available to a restricted plan:

View Available Assets - The view button is provided to enable the counselor to view and print the assets available for investment in the selected plan. This button will only be enabled when the counselor has specified yes for Restricted Funds. The system will display the assets for the plan identified in the company/plan fields.

## 5 INVESTMENT ANALYSIS: EXPERIENCE

Fig. 3E is a questionnaire screen for entering data regarding the client's past investment experience. The Experience screen is the last screen within the risk quiz portion of the Questionnaire. The following new elements were added in support of the Auto Rebalancing project:

10 Model Grids - This area is display only. It will show the range of Ibbotson scores associated with each of the seven target portfolios.

Current SAA - This text box will display the client's current percent asset allocation and the dollar amount currently held in each asset class.

15 Investment Stage - Radio buttons to indicate whether the client is in the income or accumulation stage. This setting will impact the preferred domain choice for the use of bonds in taxable accounts.

Annual Income Needed - This is the annual income which must be provided by the portfolio. This field will default to zero and must be entered by the counselor if a specific amount of income is expected. This field will be entered if Investment Stage is Income.  
20 If Investment Stage is Accumulation, Annual Income Needed will be set to zero and will not be enterable.

Portfolio Tilt - This is a set of push buttons used to indicate the valid portfolio tilt to be used for the customer. The tilt will change the percent allocations for target portfolio asset classes and/or modify preferred funds. Acceptable tilts are core, income, and tax  
25 efficient.

## ANALYSIS SCREEN CHANGES

The Analysis function was modified to use Auto Rebalancing to determine the contents of the proposed portfolio. Use of Auto Rebalancing is optional.

## PERFORM ANALYSIS

Fig. 4 is a screen used by the counselor to initiate the analysis and report creation.

5 This screen was modified to contain an Intermediate Review check box.

Show Intermediate Screens - This check box is used to allow the report to be completed without the need for counselor intervention. If the box is checked, the system will stop at intermediate screens, prior to creating the final report. The counselor will be able to stop the process without creating the report. If the box is unchecked, the system will run through the entire flow, not stopping until the final report is complete.

10 For PFP, the box would default to unchecked. For PAS (Personal Advisory Service), the box will default to checked. If the box is unchecked for PAS, the system would not start the “automatic” processing until the VPAS (Vanguard Personal Advisory Service) analysis portion of the flow is completed.

## 15 TARGET ALLOCATION

Fig. 5 is an existing screen currently used to specify the funds which should be added to the client’s proposed portfolio. Several new buttons/boxes have been added to this screen to support Auto Rebal and the new GUI (graphical user interface) spreadsheet. The new items are:

- 20 (1) Use Auto Rebalancing Check Box  
(2) Auto Rebalancing Button  
(3) Manual Rebalancing Button

Use Auto Rebalancing check box - The Use Auto Rebalancing check box controls whether manual updates to the Selected Funds portion of the window can be made.

25 When this box is checked, the functionality to clear the Selected Funds window, populate Selected Funds from the list of funds on the left side of the screen, and to populate Selected Funds using Get Funds are not available for use. Unchecking the Use Auto

Rebalancing box causes the controls needed to manually fill the Selected Funds box to become available. The Use Auto Rebal check box and button will be available for all counselors. Eventually, these will be available or unavailable based on the counselor's experience level. For PFP counselors, the Use Auto Rebalancing check box will default to checked.

Auto Rebalancing button - The Auto Rebalancing button causes the system to run the auto rebal algorithm to determine how the customer's portfolio should be modified to meet the target portfolio. The results of Auto Rebal will be displayed in the Selected Funds window. The buy/sell amounts specified for the funds may be changed by the counselor. If this button is pressed after changes have been made in the Selected Funds window, these changes are lost. The new results from Auto Rebal will replace, not update, the contents of the Selected Funds window.

If the counselor needs to make more complex changes to the results from Auto Rebal, the Use Auto Rebalancing box may be unchecked and funds may be manually added and/or deleted from the Selected Funds window.

Manual Rebalancing button - The Manual Rebalancing button causes the GUI spread sheet to be displayed.

OK button - The OK button will continue to function as it does currently. When this button is pressed, the Excel Rebalancing spread sheet is displayed and the report can be run.

## NEW GUI REBAL WORKSHEET

Fig. 6 shows the GUI Rebal Worksheet which allows the counselor to specify buy/sell amounts for the funds held by the customer or added to the portfolio via the Target Allocation window. The display shows the assets by asset class so that the counselor can determine whether the proposed portfolio is meeting the targets. When the counselor presses the OK button, the Target Allocation screen is displayed with the changes made on the GUI Worksheet shown in the Selected Funds window.

## PART II.

### SUMMARY

This portion of the disclosure provides the logic for the auto-rebal project (the automated process for developing investment plans). One of the main purposes of auto-rebal is to eliminate the labor intensive aspects of generating an Investment Planning Analysis (IPA). A summary of how a client's asset allocation is determined is presented first, since this is the framework around auto-rebal and its functionality. That methodology is behind the preferred domain logic (steps) that will provide the foundation for auto-rebal. Auto-rebal may address only repositionable and non-repositionable assets. This should allow PFP to automate 70%+ of all IPAs. Alternatively, auto-rebal may address repositionable and non-repositionable assets, as well as "possibly repositionable assets." While the functionality of possibly repositionable assets will not be immediately addressed from a systems standpoint, they will from an implementation standpoint. However, it is critical to the success of auto-rebal that the repositionable functionality be automated and that counselors have the ability on the front end to flush out these issues with clients. Finally, sample language is provided that will be programmed to flow in the report automatically. This will enable the IPA to be fully automated.

All Investment Assets will be one of the following:

1. Non-Repositionable - These assets will never be sold and repositioned to Vanguard funds.

2. Repositionable - These assets will be liquidated and invested in Vanguard funds according to preferred domain rules.

3. Possibly Repositionable -

Are assets needed to reach target SAA?

If no, do not reposition. If yes, reposition based on conditionality.

Possibly repositioned assets will be constrained by client preferences, tax costs and redemption fees. Whether or not these assets will be moved to Vanguard will be determined by the counselor. These possibly repositioned assets will be run as non-

repositionable at first. If the target SAA is not met then the counselor will re-run the plan with certain assets as repositionable or because of constraints leave the assets alone.

## DETERMINING ASSET ALLOCATION

The following steps should be followed when determining a client's strategic asset allocation. This is the first step in the auto-rebal process.

Step 1. Total Assets - determine the client's total investment assets. This is the total amount of assets from the "Show Current."

Step 2. Cash Reserves - subtract out any cash reserves that the client cannot or will not reposition from total assets. These are cash reserves that are included in the report, but are not being repositioned. This does not include emergency reserves that are not included in the analysis.

Note: If the client has a target Portfolio of 1 or 2 as shown in Fig. 6, use the cash reserves that are not repositioned to meet their target cash reserves allocation.

Step 3. Strategic Asset Allocation (SAA) - determine the dollar amount that should be invested in stocks, bonds and cash reserves based upon the client's Ibbotson score.

Step 4. Compare SAAs - compare the target dollar amount of stocks, bonds and cash reserves to the client's proposed allocation. For example, a client has a \$1 million portfolio: \$800,000 in stocks (\$600,000 is non-repositionable), \$100,000 in bonds (all repositionable) and \$100,000 in cash reserves (all repositionable). The target portfolio is four, 50% stocks and 50% bonds. The proposed portfolio will be \$600,000 in stocks and \$400,000 in bonds because the client will only reposition \$200,000 of stocks.

Note: Any time a client has a current non-repositionable position in an asset or subasset class that exceeds the target, propose the higher non-repositionable amount. Then adjust the other asset or subasset classes accordingly.

Step 5. Determine Stock Suballocation - compute the dollar amount that you will propose for each stock subasset class as follows:

1. Determine the allocation to foreign stocks.

2. Subtract out foreign stocks and individual stocks from the total proposed stock allocation.

3. Multiply 70% times the remaining proposed allocation to stocks after subtracting out foreign and individual stocks to determine allocation to large cap stocks.

5 4. Multiply 30% times the remaining proposed allocation to stocks after subtracting out foreign and individual stocks to determine allocation to mid/small cap stocks.

Note: If the client has non-repositionable positions in a stock subasset class that exceeds the target, propose the higher non-repositionable amount. Then adjust the other asset or subasset classes accordingly. For example, after subtracting foreign and individual  
10 stocks, you have \$100,000 to allocate to U.S. stocks. The target would be \$70,000 large and \$30,000 mid/small. However, the client has \$80,000 of non-repositionable large cap stocks, the proposed allocation should be \$80,000 large and \$20,000 mid/small.

15 Step 6. Determine Bond Suballocation - compute the dollar amount that you will propose for each bond subasset class as follows:

1. Subtract out individual bonds from the total proposed bond allocation.

2. Multiply the appropriate bond suballocations to the remaining bond allocation after subtracting out individual bonds to determine exposure to short-, intermediate- and long-term bonds.

20 Note: If the client has non-repositionable positions in a bond subasset class that exceeds the target, propose the higher non-repositionable amount. Then adjust the other asset or subasset classes accordingly. For example, after subtracting individual bonds, you have \$1,000,000 to allocate to bond funds. The target is 18% (\$360,000) short-, 27% (\$540,000) intermediate- and 5% (\$100,000) long-term bonds, based on a 50/50 portfolio.

25 However, if the client has \$200,000 of non-repositionable long-term bonds, there is only \$800,000 to allocate between short- and intermediate-term, rather than the needed \$900,000. You would propose \$320,000 in short-term bonds (\$800,000 times 18%/45%), \$480,000 in intermediate-term bonds (\$800,000 times 27%/45%) and \$200,000 in long-term bonds.

Step 7. Determine Cash Allocation - The client will have a proposed cash allocation if the target portfolio is number 1 or number 2 or if there are non-repositionable cash reserves.

The above logic will provide the client's asset and sub-asset allocation dollar amounts. Once these dollar amounts are determined we can use the Preferred Domain Rules.

## PREFERRED DOMAIN

Before proceeding to the Preferred Domain Rules, the system will have liquidated all repositionable assets. These proceeds will have been placed in a repositionable money market on a per registration basis. For example, each registration will have a repositionable money market that purchases will be made from.

The only asset and subasset classes that will be considered (for purchases) are those where the target dollar amount is greater than the current dollar amount. If the current asset or subasset dollar amount is greater than the target, the current dollar amount will be used. Determining the proposed amounts will be a function of applying the appropriate ratios based on the target SAA.

When applying preferred domain, taxable investments are always considered first. If the client is in the 39.6% MTB or has an income need, start with the Bonds Outside Hierarchy (based on tax bracket). If the client is in the accumulation stage, or does not have an income need, start with the Stocks Outside Hierarchy. Then, follow the appropriate combination paths that are listed at the end of the hierarchy sets.

### I. Stock Outside Hierarchy

(If Current Stock Allocation is less than the Target Stock Allocation after all repositionable assets have been liquidated and placed into a money market, continue. If not, proceed to the next step in the determined hierarchy. This logic holds true when determining whether any additional money will be added to an asset or sub-asset class).



A. Large Cap Stocks

1. Index/Market Exposure\*

a. If client has S&P 500 or alternate Vanguard fund, add to Vanguard S&P 500 fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard index/market exposure, open a new Vanguard S&P 500 fund, and add to it to the extent that proposed equals target.

2. Growth Exposure

a. If client has U.S. Growth or alternate Vanguard fund, add to Vanguard U.S. Growth fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard growth exposure, open a new Vanguard U.S. Growth fund, and add to it to the extent that proposed equals target.

3. Value Exposure

a. If client has Windsor II or alternate Vanguard fund, add to Vanguard Windsor II fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard value exposure, open a new Vanguard Windsor II fund, and add to it to the extent that proposed equals target.

B. Mid/Small Cap Stocks

1. Index/Market Exposure\*

a. If client has Extended Market or alternate Vanguard fund, add to Vanguard Extended Market fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard index/market exposure, open a new Vanguard Extended Market fund, and add to it to the extent that proposed equals target.

## 2. Active Mid Cap Exposure

a. If client has Horizon Aggressive Growth or alternate Vanguard fund, add to Vanguard Horizon Aggressive Growth fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

5           b. If client does not have any Vanguard active mid cap exposure, open a new Vanguard Horizon Aggressive Growth fund, and add to it to the extent that proposed equals target.

## 3. Active Small Cap Exposure

10           a. If client has Explorer or alternate Vanguard fund, add to Vanguard Explorer fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

            b. If client does not have any Vanguard active small cap exposure, open a new Vanguard Explorer fund, and add to it to the extent that proposed equals target.

\* If A1 and B1 provide a 70/30 split, substitute TSMP

## 15   C. International Exposure

### 1. International Developed\*\*

20           a. If client has European Index or Pacific Index or alternate Vanguard fund, add to European Index or Pacific Index funds to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

            b. If client does not have any Vanguard international developed exposure, open a new Vanguard European Index or Pacific Index fund, and add to it to the extent that proposed equals target.

### 2. International Emerging\*\*

a. If client has Emerging Markets or alternate Vanguard fund, add to Vanguard Emerging Markets fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard international emerging exposure, open a new Vanguard Emerging Markets fund, and add to it to the extent that proposed equals target.

\*\* If C1 and C2 provide an 80/20 split, or if there is no international exposure, use European Index or Pacific Index

## II. Stock Inside Hierarchy

(If Current Stock Allocation is less than the Target Stock Allocation after all repositionable assets have been liquidated and placed into a money market, continue. If not, proceed to the next step in the determined hierarchy. This logic holds true when determining whether any additional money will be added to an asset or sub-asset class).

### A. International Exposure

#### 1. International Developed\*\*\*

a. If client has European Index or Pacific Index or alternate Vanguard fund, add to Vanguard European Index or Pacific Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard international developed exposure, open a new Vanguard European Index or Pacific Index fund, and add to it to the extent that proposed equals target.

#### 2. International Emerging\*\*\*

a. If client has Emerging Markets or alternate Vanguard fund, add to Vanguard Emerging Markets fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard international emerging exposure, open a new Vanguard Emerging Markets fund, and add to it to the extent that proposed equals target.

5 \*\*\* If A1 and A2 provide an 80/20 split, or if there is no international exposure, use European Index or Pacific Index

## B. Mid/Small Cap Stocks

### 1. Active Small Cap Exposure

10 a. If client has Explorer or alternate Vanguard fund, add to Vanguard Explorer fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard active small cap exposure, open a new Vanguard Explorer fund, and add to it to the extent that proposed equals target.

### 2. Active Mid Cap Exposure

15 a. If client has Horizon Aggressive Growth or alternate Vanguard fund, add to Vanguard Horizon Aggressive Growth fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard active mid cap exposure, open a new Vanguard Horizon Aggressive Growth fund, and add to it to the extent that proposed equals target.

### 20 3. Index/Market Exposure\*\*\*\*

a. If client has Extended Market or alternate Vanguard fund, add to Vanguard Extended Market fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

25 b. If client does not have any Vanguard index/market exposure, open a new Vanguard Extended Market fund, and add to it to the extent that proposed equals target.

### C. Large Cap Stocks

#### 1. Value Exposure

a. If client has Windsor II or alternate Vanguard fund, add to Vanguard Windsor II fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard value exposure, open a new Vanguard Windsor II fund, and add to it to the extent that proposed equals target.

#### 2. Growth Exposure

a. If client has U.S. Growth or alternate Vanguard fund, add to Vanguard U.S. Growth fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard growth exposure, open a new Vanguard U.S. Growth fund, and add to it to the extent that proposed equals target.

#### 3. Index/Market Exposure\*\*\*\*

a. If client has S&P 500 or alternate Vanguard fund, add to Vanguard S&P 500 fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard index/market exposure, open a new Vanguard S&P 500 fund, and add to it to the extent that proposed equals target.

\*\*\*\* If B3 and C3 provide a 70/30 split, substitute TSMP

### III. Bonds Outside Hierarchy

(If Current Bond Allocation is less than the Target Bond Allocation after all repositionable assets have been liquidated and placed into a money market, continue. If not, proceed to the next step in the determined hierarchy. This logic holds true when determining whether any additional money will be added to an asset or sub-asset class).

A. 31% MTB and Higher

1. Long-Term Municipal Exposure

a. If client has Insured Long-Term Municipal (or State specific) or alternate Vanguard fund, add to Vanguard Insured Long-Term Municipal Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard long-term municipal bond exposure, open a new Vanguard Insured Long-Term Municipal Bond fund (or State specific), and add to it to the extent that proposed equals target.

2. High-Yield Municipal Exposure

a. If client has High-Yield Municipal or alternate Vanguard fund, add to Vanguard High-Yield Municipal Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard high-yield municipal bond exposure, open a new Vanguard High-Yield Municipal Bond fund, and add to it to the extent that proposed equals target.

3. Intermediate-Term Municipal Exposure

a. If client has Intermediate-Term Municipal (or State specific) or alternate Vanguard fund, add to Vanguard Intermediate-Term Municipal Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard intermediate-term municipal bond exposure, open a new Vanguard Intermediate-Term Municipal Bond fund, and add to it to the extent that proposed equals target.

4. Short-Term Municipal Exposure

a. If client has Limited-Term/Short-Term Municipal (or State specific) or alternate Vanguard fund, add to Vanguard Short-Term Municipal Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

5           b. If client does not have any Vanguard short-term municipal bond exposure, open a new Vanguard Limited-Term/Short-Term Municipal Bond fund, and add to it to the extent that proposed equals target.

#### B. 28% MTB and Higher

##### 1. Long-Term Municipal Exposure

10           a. If client has Insured Long-Term Municipal (or State specific) or alternate Vanguard fund, add to Vanguard Insured Long-Term Municipal Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

15           b. If client does not have any Vanguard long-term municipal bond exposure, open a new Vanguard Insured Long-Term Municipal Bond fund (or State specific), and add to it to the extent that proposed equals target.

##### 2. High-Yield Municipal Exposure

20           a. If client has High-Yield Municipal or alternate Vanguard fund, add to Vanguard High-Yield Municipal Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

            b. If client does not have any Vanguard high-yield municipal bond exposure, open a new Vanguard High-Yield Municipal Bond fund, and add to it to the extent that proposed equals target.

##### 3. Intermediate-Term Municipal Exposure

25           a. If client has Intermediate-Term Municipal (or State specific) or alternate Vanguard fund, add to Vanguard Intermediate-Term Municipal Bond fund to the extent

that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard intermediate-term municipal bond exposure, open a new Vanguard Intermediate-Term Municipal Bond fund, and add to it to the extent that proposed equals target.

#### 4. Short-Term Exposure

##### a. Active

1. If client has Short-Term Corporate or alternate Vanguard fund, add to Vanguard Short-Term Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard short-term active bond exposure, open a new Vanguard Short-Term Corporate Bond fund, and add to it to the extent that proposed equals target.

##### b. Passive

1. If client has Short-Term Bond Index or alternate Vanguard fund, add to Vanguard Short-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard short-term passive bond exposure, open a new Vanguard Short-Term Bond Index fund, and add to it to the extent that proposed equals target.

#### C. 15% MTB and Higher

##### 1. Long-Term Exposure

a. If client has Long-Term Bond Index or alternate Vanguard fund, add to Vanguard Long-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).



b. If client does not have any Vanguard long-term bond exposure, open a new Vanguard Long-Term Bond Index fund, and add to it to the extent that proposed equals target.

## 2. High-Yield Exposure

a. If client has High-Yield Corporate or alternate Vanguard fund, add to Vanguard High-Yield Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard high-yield bond exposure, open a new Vanguard High-Yield Corporate Bond fund, and add to it to the extent that proposed equals target.

## 3. Intermediate-Term Exposure

### a. Active

1. If client has Intermediate-Term Corporate or alternate Vanguard fund, add to Vanguard Intermediate-Term Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard intermediate-term active bond exposure, open a new Vanguard Intermediate-Term Corporate fund, and add to it to the extent that proposed equals target.

### b. Passive

1. If client has Intermediate-Term Bond Index or alternate Vanguard fund, add to Vanguard Intermediate-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard intermediate-term passive bond exposure, open a new Vanguard Intermediate-Term Bond Index fund, and add to it to the extent that proposed equals target.

#### 4. Short-Term Exposure

##### a. Active

1. If client has Short-Term Corporate or alternate Vanguard fund, add to Vanguard Short-Term Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard short-term active bond exposure, open a new Vanguard Short-Term Corporate Bond fund, and add to it to the extent that proposed equals target.

##### b. Passive

1. If client has Short-Term Bond Index or alternate Vanguard fund, add to Vanguard Short-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard short-term passive bond exposure, open a new Vanguard Short-Term Bond Index fund, and add to it to the extent that proposed equals target.

#### IV. Bonds Inside Hierarchy

(If Current Bond Allocation is less than the Target Bond Allocation after all repositionable assets have been liquidated and placed into a money market, continue. If not, proceed to the next step in the determined hierarchy. This logic holds true when determining whether any additional money will be added to an asset or sub-asset class).

##### 1. Short-Term Exposure

##### a. Active

1. If client has Short-Term Corporate or alternate Vanguard fund, add to Vanguard Short-Term Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard short-term active bond exposure, open a new Vanguard Short-Term Corporate Bond fund, and add to it to the extent that proposed equals target.

b. Passive

1. If client has Short-Term Bond Index or alternate Vanguard fund, add to Vanguard Short-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

5           2. If client does not have any Vanguard short-term passive bond exposure, open a new Vanguard Short-Term Bond Index fund, and add to it to the extent that proposed equals target.

2. Intermediate-Term Exposure

a. Active

10           1. If client has Intermediate-Term Corporate or alternate Vanguard fund, add to Vanguard Intermediate-Term Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

15           2. If client does not have any Vanguard intermediate-term active bond exposure, open a new Vanguard Intermediate-Term Corporate fund, and add to it to the extent that proposed equals target.

b. Passive

20           1. If client has Intermediate-Term Bond Index or alternate Vanguard fund, add to Vanguard Intermediate-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

2. If client does not have any Vanguard intermediate-term passive bond exposure, open a new Vanguard Intermediate-Term Bond Index fund, and add to it to the extent that proposed equals target.

25           3. High-Yield Exposure

a. If client has High-Yield Corporate or alternate Vanguard fund, add to Vanguard High-Yield Corporate Bond fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard high-yield bond exposure, open a new Vanguard High-Yield Corporate Bond fund, and add to it to the extent that proposed equals target.

#### 4. Long-Term Exposure

a. If client has Long-Term Bond Index or alternate Vanguard fund, add to Vanguard Long-Term Bond Index fund to the extent that proposed equals target (only add to alternate fund if client does not own “preferred fund” in this registration).

b. If client does not have any Vanguard long-term bond exposure, open a new Vanguard Long-Term Bond Index fund, and add to it to the extent that proposed equals target.

#### COMBINATIONS

The following are the various combinations that will be used depending upon the preferred domain rules. When making purchases, on a per registration basis, the registration with the highest dollar amount will be used first.

A. Bonds Outside First (when there is not enough money to fully fund the bond exposure using all taxable dollars)

The following order should be used:

Bonds Outside Hierarchy (based on tax bracket)

Bonds Inside Hierarchy

Stocks Inside Hierarchy

B. Bonds Outside First (when there is enough money to fully fund the bond exposure using all taxable dollars)

The following order should be used:

Bonds Outside Hierarchy (based on tax bracket)

Stocks Outside Hierarchy

Stocks Inside Hierarchy

- 5 C. Stocks Outside First (when there is not enough money to fully fund the stock exposure using all taxable dollars)

The following order should be used:

Stocks Outside Hierarchy

Stocks Inside Hierarchy

Bonds Inside Hierarchy

- 10 D. Stocks Outside First (when there is enough money to fully fund the stock exposure using all taxable dollars)

The following order should be used:

Stocks Outside Hierarchy

Bonds Outside Hierarchy (based on tax bracket)

- 15 Bonds Inside Hierarchy

#### TEXT

Before each set of steps, a heading that reads “Exchanges Within Your Joint Accounts” (or that registration title) is inserted. Each Registration ultimately has up to four steps. However, if any of the above steps are not used, the step numbers adjust to be sequential.

- 20 Each step has its own Tax Impact followed by its own Transaction Fees. Since Vanguard and non-Vanguard redemptions, and Vanguard purchases, each have their own step, combining tax and fee notes is not a concern.

#### VANGUARD ASSETS

Step 1 - Exchange \$25,000 from your joint Vanguard Windsor II Fund and \$25,000, or all remaining shares, from your Vanguard U.S. Growth Fund to a new or your existing Vanguard Money Market Prime Portfolio.

Step 2 - Exchange \$50,000, or all shares, from your Vanguard Money Market Prime Portfolio to the following Vanguard Funds:

(1) \$ amount to fund

(2) \$ amount to fund

(add "or all remaining shares" to text in last purchase, if a full redemption)

#### NON-VANGUARD REPOSITIONABLE ASSETS

Step 1 - Liquidate the following assets: list funds to be sold and dollar value, where appropriate add "or all shares". Invest the proceeds in a new or your existing Vanguard Money Market Prime Portfolio.

Step 2 - Exchange \$50,000, or all shares, from your Vanguard Money Market Prime Portfolio to the following Vanguard Funds:

(1) \$ amount to fund

(2) \$ amount to fund

(add "or all remaining shares" to text in last purchase, if a full redemption)

#### NON-VANGUARD "POSSIBLY" REPOSITIONABLE ASSETS

This language will be used by counselors when "possibly" repositionable assets are sold. When the "possibly" repositionable functionality is added to auto-rebal, this text will be inserted automatically.

Step 1 - In order to reach your target asset allocation, liquidate the following assets: list funds to be sold and dollar value, where appropriate add "or all shares". Invest the proceeds in a new or your existing Vanguard Money Market Prime Portfolio.

Step 2 - Exchange \$50,000, or all shares, from your Vanguard Money Market Prime Portfolio to the following Vanguard Funds:

(1) \$ amount to fund

(2) \$ amount to fund

5 (add "or all remaining shares" to text in last purchase, if a full redemption)

Note: On a per registration basis, all sales will be made first. The following hierarchy will be used for each registration:

Step 1. Exchanges of Vanguard funds.

Step 2. Exchanges of repositionable non-Vanguard funds.

10 Step 3. Exchanges of "possibly" repositionable non-Vanguard funds.\*

Step 4. Purchases of Vanguard funds.

\*Step 3 is separated out by the counselor if possibly repositionable are not addressed.

#### TAX COST

15 Tax Cost information will flow into the report based on the data entered into the system by the counselor. If the fund is a money market, the tax cost will be none. If redeeming a money market is part of several redemptions, that fund will not be part of the tax cost table. For funds where tax cost is not provided (non-Vanguard funds) or is unavailable (Vanguard funds) the counselor will enter a zero under cost basis in the system. If one of these funds is sold, the average cost not available language will flow in for Vanguard  
20 and/or non-Vanguard funds.

Vanguard Tax Cost Available:

Tax Impact: The following is a summary of the potential tax consequences associated with the above recommendation. We use the average cost (single category) method to compute gains and losses on liquidations. Your actual gain or loss may vary.

25 Fund<sup>1</sup> Redemption Cost Basis<sup>2</sup> Redemption Proceeds<sup>3</sup> Gain/Loss<sup>4</sup>

1 = Fund sold.

2 = Shares sold multiplied by average cost per share. If total redemption, it equals total cost.

5 3 = Shares sold multiplied by current price per share. If total redemption, it equals total value.

4 = Redemption Proceeds minus Redemption Cost Basis. Negative numbers have brackets, i.e. (\$200)

#### Non-Vanguard Tax Cost Available:

10 Tax Impact: The following is a summary of the potential tax consequences associated with the above recommendation. The potential gains or losses are based on the information that you provided.

Fund <sup>1</sup>	Redemption Cost Basis <sup>2</sup>	Redemption Proceeds <sup>3</sup>	Gain/Loss <sup>4</sup>
-------------------	------------------------------------	----------------------------------	------------------------

1 = Fund sold.

15 2 = Shares sold multiplied by average cost per share. If total redemption, it equals total cost.

3 = Shares sold multiplied by current price per share. If total redemption, it equals total value.

4 = Redemption Proceeds minus Redemption Cost Basis. Negative numbers have brackets, i.e., (\$200)

#### 20 Vanguard Tax Cost not Available:

Tax Impact: Average cost information on the above account(s) is pending and will be discussed prior to implementation.

Non-Vanguard Tax Cost not Available:



Tax Impact: The above recommendation was made without regard to cost basis. Please consider the tax ramifications of this transaction before implementing the above recommendation.

Some Vanguard Tax Cost Available:

- 5 Tax Impact: Average cost information on the following accounts is pending: list funds with "zero" cost basis, and will be discussed prior to implementation. The following is a summary of the potential tax consequences associated with selling the remaining funds. We use the average cost (single category) method to compute gains and losses on liquidations. Your actual gain/loss may vary.

10 Fund<sup>1</sup> Redemption Cost Basis<sup>2</sup> Redemption Proceeds<sup>3</sup> Gain/Loss<sup>4</sup>

1 = Fund sold.

2 = Shares sold multiplied by average cost per share. If total redemption, it equals total cost.

15 3 = Shares sold multiplied by current price per share. If total redemption, it equals total value.

4 = Redemption Proceeds minus Redemption Cost Basis. Negative numbers have brackets,

i.e. (\$200)

Some Non-Vanguard Tax Cost Available:

- 20 Tax Impact: The above recommendation considered cost basis where provided. The following represents your potential gains or losses for funds where cost basis was provided.

TRANSACTION FEES

Vanguard Transaction Fees:

Transaction Fees (New Funds): Please refer to “Your Fund Recommendations” section and prospectus for any applicable transaction fees associated with investing in . . . (the funds with possible or definite purchase or redemption fees will be listed based on the buy/sell recommendations).

Transaction Fees (Existing Funds): Please refer to your fund prospectus for any applicable transaction fees associated with investing in . . . (the funds with possible or definite purchase or redemption fees will be listed based on the buy/sell recommendations).

OR

Transaction Fees: None.

Non-Vanguard Transaction Fees:

Transaction Fees: Please consult with the above providers for any fees associated with this transaction.

DOLLAR-COST AVERAGING

The dollar amount to dollar-cost average will equal the proposed stock amount minus the current stock amount. We will only recommend dollar-cost-averaging when the proposed stock percentage increases by 10% or more over the current stock percentage. That dollar amount will be dollar-cost averaged over one year. The language is as follows: (\$1/5<sup>th</sup> amount initially, and \$1/5<sup>th</sup> amount every three months over the course of a year, for a total of five exchanges). The second 1/5<sup>th</sup> amount will be rounded to the nearest \$100 and the first adjusted accordingly. The system will dollar-cost average into stock funds until it reaches the total needed, adding the above text next to each fund it DCA's into.

## VANGUARD FUND CHOICES (Core Portfolio)

### I. Stocks

#### A. Large U.S. Stocks

##### 1. Market/Index

- a. Preferred - 500 Portfolio
- b. Alternate - Quantitative, Trustees' Equity and Tax-

#### Managed Growth & Income

##### 2. Growth

- a. Preferred - U.S. Growth
- b. Alternate - Morgan Growth and Index Growth

##### 3. Value

- a. Preferred - Windsor II
- b. Alternate - Windsor, Equity Income and Index Value

#### B. U.S. Total Stock Market (to be used when large market/index to mid/small market/index equals 70/30)

- 1. Preferred - Total Stock Market
- 2. Alternate - Tax-Managed Capital Appreciation

#### C. Mid/Small U.S. Stocks

##### 1. Market/Index

- a. Preferred - Extended Market
- b. Alternate - Index Small Cap

##### 2. Mid Cap Active

- a. Preferred - Horizon - Aggressive Growth
- b. Alternate - Primecap, Selected Value, Horizon - Capital Opportunity and REIT Index

3. Small Cap Active
  - a. Preferred - Explorer
  - b. Alternate - None

D. International Stocks

1. Developed
  - a. Preferred - European (50%) and Pacific (50%)
  - b. Alternate - International Growth and Trustees' International
2. Emerging
  - a. Preferred - Emerging Markets Index
  - b. Alternate - None
3. European Index or Pacific Index (to be used when there is an 80/20 ratio between developed and emerging)
  - a. Preferred - European Index or Pacific Index
  - b. Alternate - None

II. Bonds

A. High Yield

1. Municipal
  - a. Preferred - High Yield Muni
  - b. Alternate - None
2. Corporate
  - a. Preferred - High Yield Corporate
  - b. Alternate - None

B. Long-Term

1. Municipal
  - a. Preferred - Insured Long-Term Muni or State specific Muni

- b. Alternate - Long-Term Muni
  - 2. Taxable
    - a. Preferred - Long-Term Bond Index
    - b. Alternate - Long-Term Corporate, Admiral Long-Term U.S. Treasury and Long-Term U.S. Treasury

C. Intermediate-Term

- 1. Municipal
    - a. Preferred - Intermediate-Term Muni or State specific Muni
    - b. Alternate - None
  - 2. Active
    - a. Preferred - Intermediate-Term Corporate
    - b. Alternate - Admiral Intermediate-Term U.S. Treasury, Intermediate-Term U.S. Treasury
  - 3. Passive
    - a. Preferred - Intermediate-Term Bond Index
    - b. Alternate - Total Bond Market Index

D. Short-Term

- 1. Municipal
    - a. Preferred - Short-Term Muni (Portfolio 1) and Limited-Term and Muni (Portfolio 2 - 7)
    - b. Alternate - Limited-Term Muni (Portfolio 1) and Short-Term Muni (Portfolio 2 - 7)
  - 2. Active
    - a. Preferred - Short-Term Corporate
    - b. Alternate - Short-Term Admiral U.S. Treasury, Short-Term U.S. Treasury
  - 3. Passive

- a. Preferred - Short-Term Bond Index
- b. Alternate - None

## VANGUARD FUND CHOICES (Tax-Efficient Portfolio)

### I. Stocks

- 5           A.    U.S. Total Stock Market (to be used when large market/index to mid/small market/index equals 70/30)
  - 1.    Preferred - Total Stock Market (50%) and Tax-Managed Capital Appreciation (50%)
  - 2.    Alternate - None
- 10          B.    Large U.S. Stocks
  - 1.    Market/Index
    - a.    Preferred - None, only use alternate when Total Stock Market and Capital Appreciation cannot be used
    - b.    Alternate - Tax-Managed Growth & Income (50%) and 500 Portfolio (50%)
- 15          C.    Mid/Small U.S. Stocks
  - 1.    Market/Index
    - a.    Preferred - None, only use alternate when Total Stock Market and Capital Appreciation cannot be used
    - b.    Alternate - Extended Market (50%) and Small Cap (50%)
- 20          D.    International Stocks
  - 1.    Developed
    - a.    Preferred - Pacific (50%) and Europe (50%)

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- b. Alternate - None
  - 2. Emerging
    - a. Preferred - Emerging Markets Index
    - b. Alternate - None
  - 3. European Index or Pacific Index (to be used when there is an 80/20 ratio between developed and emerging)
    - a. Preferred - European Index or Pacific Index
    - b. Alternate - None

II. Bonds

- A. High Yield
  - 1. Municipal
    - a. Preferred - High Yield Muni
    - b. Alternate - None
  - 2. Corporate
    - a. Preferred - High Yield Corporate
    - b. Alternate - None
- B. Long-Term
  - 1. Municipal
    - a. Preferred - Insured Long-Term Muni or State specific Muni
    - b. Alternate - Long-Term Muni
  - 2. Taxable
    - a. Preferred - Long-Term Bond Index
    - b. Alternate - Long-Term Corporate, Admiral Long-Term U.S. Treasury and Long-Term U.S. Treasury

- C. Intermediate-Term





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- A. Large U.S. Stocks
    - 1. Market/Index
      - a. Preferred - 500 Portfolio
      - b. Alternate - Quantitative, Trustees' Equity and Tax-
  - 5 Managed Growth & Income
    - 2. Growth
      - a. Preferred - None
      - b. Alternate - None
    - 3. Value
      - a. Preferred - Windsor II (50%) and Equity Income (50%)
      - b. Alternate - Windsor and Index Value
  - 10
    - B. U.S. Total Stock Market (to be used when large market/index to mid/small market/index equals 70/30)
      - 1. Preferred - Total Stock Market
      - 2. Alternate - Tax-Managed Capital Appreciation
  - 15
    - C. Mid/Small U.S. Stocks
      - 1. Market/Index
        - a. Preferred - Extended Market
        - b. Alternate - Index Small Cap
      - 2. Mid/Small Active
        - a. Preferred - REIT Index
        - b. Alternate - Primecap, Selected Value, Horizon - Capital Opportunity and Explorer
  - 20
    - D. International Stocks
      - 1. Developed
        - a. Preferred - European (50%) and Pacific (50%)
  - 25

5

- b. Alternate - International Growth and Trustees' International
- 2. Emerging
  - a. Preferred - Emerging Markets Index
  - b. Alternate - None
- 3. European Index or Pacific Index (to be used when there is an 80/20 ratio between developed and emerging)
  - a. Preferred - European Index or Pacific Index
  - b. Alternate - None

## II. Bonds

10

### A. High Yield

- 1. Municipal
  - a. Preferred - High Yield Muni
  - b. Alternate - None
- 2. Corporate
  - a. Preferred - High Yield Corporate
  - b. Alternate - None

15

### B. Long-Term

- 1. Municipal
  - a. Preferred - None
  - b. Alternate - None
- 2. Taxable
  - a. Preferred - Long-Term Corporate
  - b. Alternate - None

20

### C. Intermediate-Term

- 1. Municipal

25

- a. Preferred - Intermediate-Term Muni or State specific Muni
    - b. Alternate - None
  - 2. Active
    - a. Preferred - Intermediate-Term Corporate
    - b. Alternate - None
  - 3. Passive
    - a. Preferred - None
    - b. Alternate - None
- D. Short-Term
  - 1. Municipal
    - a. Preferred - Short-Term Muni and Limited-Term and Muni (Portfolio 1 and 2)
    - b. Alternate - None
  - 2. Active
    - a. Preferred - Short-Term Corporate
    - b. Alternate - None
  - 3. Passive
    - a. Preferred - None
    - b. Alternate - None

## 20 VANGUARD FUND CHOICES (Annuity)

### I. Stocks

#### A. Large U.S. Stocks

- 1. Market/Index
  - a. Preferred - Equity Index
  - b. Alternate - None

- 5
- 2. Growth
    - a. Preferred - Growth Portfolio
    - b. Alternate - None
  - 3. Value
    - a. Preferred - Equity Income
    - b. Alternate - None
- 10
- B. Mid/Small U.S. Stocks
    - 1. Small Cap Active
      - a. Preferred - Small Company Growth
      - b. Alternate - None
- 15
- D. International Stocks
    - 1. Developed
      - a. Preferred - International
      - b. Alternate - None
- 20
- II. Bonds
    - A. High Yield
      - 1. Corporate
        - a. Preferred - High Yield Bond
        - b. Alternate - None
    - B. Intermediate-Term
      - 1. Passive
        - a. Preferred - High Grade Bond Index
        - b. Alternate - None

## SELLING POSSIBLY REPOSITIONABLE ASSETS

Once we have the functionality to add “possibly repositionable” assets to the system program, we will need a decision-making hierarchy to determine when, if at all, assets will be sold. There are two factors that will influence this decision: how close the client’s strategic asset allocation (SAA) is to the target, without any further sales, and the tax cost associated with selling additional assets.

### Step 1: Compare SAAs

If the client’s SAA is within three percentage points (+/- 3%) of the target, after selling all “repositionable” assets, do not consider selling any “possibly repositionable” assets.

If the client’s SAA is not within three percentage points (+/- 3%) of the target, after selling all “repositionable assets”, consider the tax cost of selling any “possibly repositionable” assets.

Rationale: Having a portfolio that is within 3 percent of the target should give a client a proposed portfolio with similar risk/return characteristics to the target portfolio. A portfolio 3% or less off target will behave similarly to the ideal target, but would have to be re-balanced in the future.

### Step 2: Consider the tax cost

In order to get the client’s SAA within three percentage points of the target, sell “possibly repositionable” assets until the tax cost equals five percent of the value of the portfolio.

(The tax cost equals the market value minus the cost basis times 20% or 10%.)

Liquidations will be made until the earlier of: (1) the proposed SAA is within three percent of the target or (2) the tax cost (including the cost of previous moves) equals five percent of the portfolio. Assets with the least tax cost will be sold first.

Note: It is possible that selling “repositionable” assets will result in a tax cost greater than five percent. If this is the case, no “possibly repositionable” assets will be sold.

Rationale (five percent rule): If the overall tax cost from the sale of securities is no greater than 5% of the portfolio (in aggregate), sales are made until the tax obligation

equals 5% of the overall portfolio. Priority of sale is based on (a) tax consequence, lowest to highest (within each over-weighted asset or sub-asset class. The five percent threshold came from the fact that, in most of our allocations, the client would still have a positive real after-tax return, or the client's real wealth would not decline in most cases.

- 5      Rationale (20% and 10% tax rate): Using a 20% tax rate (or 10% for taxpayers in the 15% MTB) will be an accurate way to estimate a client's tax liability. It will understate their tax cost when they have a short-term holding period and their MTB is greater than 15%. (The likelihood of this is mitigated by the fact that assets greatly appreciating over a period less than twelve months, in many cases, will be non-repositionable.)

10      **SYSTEM OUTPUT EXAMPLE SHOWING SUMMARY OF CONCLUSIONS**

See the section entitled "AUTO REBAL SUMMARY" in Part I. above.

**CONCLUSION**

- 15      Part II provides the foundation for auto-rebal. By first having the repositionable and non-repositionable functionality, at least 70% of the investment planning analyses can be automated. Further development will allow the auto-rebal product to handle a larger percentage of clients. The following are recommended developmental steps for auto-rebal:

Stage 1:      Develop the foundation for auto-rebal by creating the repositionable functionality in conjunction with the preferred domain logic and automated text.

- 20      Stage 2:      Add possibly repositionable functionality that is based on a tax and fee cost analysis.

Stage 3:      Give the system (or counselor) the flexibility to choose an income tilt or tax-efficient portfolio.

Stage 4: Allow the counselor to pick the hierarchy of constraints (prioritize them) in the GUI.

### PART III

Figs. 8A-8H, taken together, provide a detailed, functional data flowchart of the Auto Rebal Model in accordance with the disclosed embodiment of the present invention.

Fig. 8A is a flowchart of the overall Auto Rebal Model. The following abbreviations are used in Fig. 8A: VPAS refers to Vanguard Personal Advisory Service, INV refers to Investment, and AR refers to Auto Rebal. "PlanIT" is the name given by Vanguard to a system program used with the present invention. PlanIT is a Sybase database application program. However, the present invention may be practiced with any suitable type of database application program. PlanIT is also referred to in the text of the linear programming (see Appendix below).

Fig. 8B is a flowchart of the analysis process associated with the Auto Rebal Model. TPFS130 refers to a database table which contains the changes to the current portfolio (buys and sells) recommended by Auto Rebal. Other tables identified by the format TPFS# are described in the text of the linear programming (see Appendix below).

Fig. 8C is a flowchart of Auto Rebal Object associated with the Auto Rebal Model. NR refers to "rebalancing is not needed" (see Status Code values in the Appendix).

Fig. 8D is a flowchart associated with portfolio rebalancing in the Auto Rebal Model.

Fig. 8E is a flowchart associated with determining how much of each current asset to sell and/or hold in the Auto Rebal Model.

Fig. 8F is a flowchart associated with determining how to invest proceeds from sales in the Auto Rebal Model.

Fig. 8G is a flowchart associated with determining how to invest proceeds from sales and for building equations for a Buy Model in the Auto Rebal Model. BE refers to "request too large for buy linear programming process" (see Status Code values in the Appendix).

Fig. 8H is a flowchart associated with determining how to invest proceeds from sales and determining which funds to buy. LINDO refers to a linear programming engine used to

solve the equations generated by Auto Rebal. The use of other linear programming engines are within the scope of the present invention.

The individual flowcharts are self-explanatory, and thus the individual steps in the flowcharts are not described in further detail herein.

5 Figs. 9A through 9H show class diagrams for all of the objects used in the present invention. The class diagrams are self-explanatory, and thus are not described in further detail herein. Additional details of the steps in the flowcharts and of the objects are provided in the linear programming version of the present invention set forth in the APPENDIX.

10 Fig. 10 is a schematic block diagram of an apparatus 10 for implementing the Auto Rebal process. The apparatus includes an input data processor 12, an Auto Rebal processor 14, a trade execution computer 16 and a Summary Report 18. PFP  
15 questionnaire data are provided to the input data processor 12 which outputs the client's current asset portfolio, asset portfolio preferences, and sell constraints, and calculates and outputs the client's desired asset allocation, preferred domain, and Ibbotson score, and communicates this information to the Auto Rebal processor 14. The Auto Rebal  
20 processor 14 uses this information to generate financial transaction recommendations, including asset buy/sell recommendations. In one embodiment of the invention, the recommendations, as well as the tax impacts and transaction costs thereof, are displayed in the Summary Report 18 for review by the client and/or the client's financial manager. In an alternative embodiment of the invention, the buy/sell recommendations are electronically communicated to the trade execution computer 16 which automatically performs the necessary transactions to execute the buy/sell recommendations. The trade  
25 execution computer 16 may be any suitable computer for executing trade orders. One example of such a computer is described in U.S. Patent No. 5,819,238 (Fernholz), the entire disclosure of which is incorporated by reference herein.

As discussed above, the investor would ideally like to rebalance the portfolio without incurring any tax implications or transaction costs. However, selling stock assets almost always has tax implications, and any buying and selling of assets incurs



transaction costs which immediately decreases the total assets of the investor. Thus, it is not necessarily beneficial to fully reach the desired asset allocation if doing so would incur excessive transaction costs and/or significant negative tax implications. The present invention addresses these issues in two ways. First, it may be programmed to recommend holding the client's possibly repositionable assets if the client's new asset allocation will be within a predetermined percentage of the desired asset allocation, such as 3%, after selling all of the client's repositionable assets. Furthermore, it may be programmed to recommend selling the client's repositionable assets until the tax cost of selling equals a predetermined percentage of the client's current asset portfolio.

Consider, for example, a client who has a desired SAA of 50% equities and 50% bonds and can rebalance from 65% equities and 35% bonds to 48% equities and 52% bonds without incurring any tax consequences, but that significant tax costs as a percentage of the client's current asset portfolio would arise by further rebalancing to the desired 50/50 ratio. In this example, the buy/sell recommendations would be selected to achieve the 48/52 ratio, instead of the 50/50 ratio. The same type of rebalancing limitations may be used with respect to transaction costs.

It will be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

## APPENDIX

### A. Auto Rebal Object.doc - Auto Rebal Object

#### Inputs

##### Rebalancing Control Variables

**Data Source:** All parameters from this section will be passed to Auto Rebal when it is called. For PFP, the parameter values will be obtained from the most recent version of the Auto Rebal Parameters Used table entry for the Client Group Id.

**Request** - Defines the function to be performed. Choices are "is rebal needed" and "rebalance". This variable will be set by PlanIT when the call is done. For phase I, this will always be "rebalance".

**Periodic Review** - Defines whether the request is for a first time or periodic review. This value will be set by PlanIT when the call is done. For phase I, this will always be "first time".

**Client Group Id** - A key which identifies the client group for whom Auto Rebal is being run. This key is used to retrieve asset and plan data specific to the client group.

**Preferred domain** - Choices are stocks "outside" or bonds outside. ("Outside" refers to investments in taxable accounts.)

**Use Muni Bonds For High Yield Bonds** - Choices are yes and no.

**Use Muni Bonds For Long Term Bonds** - Choices are yes and no.

**Use Muni Bonds For Intermediate Term Bonds** - Choices are yes and no.

**Use Muni Bonds For Short Term Bonds** - Choices are yes and no.

**m\_MinRetirementFundBalance** - Minimum balance required for a retirement account.

**M\_MinRetailFundBalance** - Minimum balance required for a retail account.

**m\_PortfolioTotalCostPct** - Percentage of the total portfolio value that is acceptable as a cost to be incurred when repositioning assets.

**Minimum Txn Amount** - Minimum dollar amount for any buy or sell transaction.

**m\_TSMPortfolioToleranceMinus** - The acceptable negative variance for the large market and mid/small index holdings for combining these purchases into a purchase of Total Stock Market Portfolio.

**m\_TSMPortfolioTolerancePlus** - The acceptable positive variance for the large market and mid/small index holdings for combining these purchases into a purchase of Total Stock Market Portfolio.

**m\_TotalIntlPortfolioToleranceMinus** - The acceptable negative variance for the foreign developed and emerging market holdings for combining these purchases into a purchase of Total International Portfolio.

m\_TotalIntlPortfolioTolerancePlus - The acceptable positive variance for the foreign developed and emerging market holdings for combining these purchases into a purchase of Total International Portfolio.

m\_BusinessArea - VGI Business area requesting auto rebalancing services. Choices are: PFP and PAS.

Carry Forward Loss - Amount of loss incurred by the customer which can be used to offset gains incurred during rebalancing.

Current Year Gains - Amount of gain incurred by the customer in other activities or incurred for the customer during previous rebalancing in the current year which should be included in the total tax cost calculation used as a limit to repositioning of assets.

m\_RoundingTo - Rounding parameter for all calculated values. Choices are to the nearest \$1 or nearest \$100.

Tax Rate Used For Calculating Tax Cost - Tax rate, expressed as a decimal amount, to be used when estimating the tax cost incurred in rebalancing the portfolio. Current values would be .10 or .20.

m\_SAAPeriodicVarianceMinus - The acceptable negative variance from the target SAA amount when determining whether or not rebalancing is needed. Used for PAS on periodic review.

m\_SAAPeriodicVariancePlus - The acceptable positive variance from the target SAA when determining whether or not rebalancing is needed. Used for PAS on periodic review.

m\_SAAVarianceMinus - The acceptable negative variance from the target SAA when determining whether rebalancing is complete.

m\_SAAVariancePlus - The acceptable positive variance from the target SAA when determining whether rebalancing is complete.

Estimate Tax Cost - Flag to indicate whether tax cost should be estimated for the purpose of determining whether to sell an asset. Possible choices are yes and no.

Estimate Tax Cost Asset % - Percentage of current asset value that should be used to estimate tax cost. This field is only valid if Estimate Tax Cost is yes. Field should be supplied as a decimal amount, <= 1.

m\_PortfolioTilt - Type of portfolio being used for the rebalancing. Valid choices are NO= core, IN = income, and TE = tax efficient.

m\_TacticalShift - The amount by which stock allocations should be decreased and bond allocations increased. Acceptable values are .05, .10, and 0.

Portfolio Number - The portfolio selected for the client based on their Ibbotson score. The value may have been modified by the counselor. Valid values are 1 through 7.

m\_TaxAcctDCAFund - The Vanguard fund number identifying the fund to be used in taxable plans for dollar cost averaging, as an intermediate fund between sells and buys, or as a cash investment. This fund will also be used if the total buy amount in a taxable plan can not be successfully invested in a target fund.

m\_TaxExmptDCAFund - The Vanguard fund number identifying the fund to be used in tax exempt plans for dollar cost averaging, as an intermediate fund between sells and buys, or as a cash investment. This fund will also be used if the total buy amount in a tax exempt plan can not be successfully invested in a target fund.

m\_LegalResidenceState - The client's legal residence state. Used for selecting municipal bond fund alternatives.

Produce Explanations - This is a yes/no flag indicating whether explanations for changes to the proposed portfolio should be produced by the system. If the flag is set to yes, the explanations should be created.

### **System Control Variables**

The following constant values are used to control the rebalancing process. These constants are stored in table tpfs302 as parameters for the SYS business area. These constants are described elsewhere in this design and specify the current value for the parameter. However, the code should retrieve the actual values from the data base.

A stored procedure must be called to retrieve this data. A record will be returned containing the following parameters:

Max # of Assets - integer value

Max # of Plans - integer value

Max # of Constraints - integer value

Max # of Variables - integer value

Required Buy Variables - integer value

Required Buy Constraints - integer value

### Target Portfolio

**Data Source:** The target portfolio is stored in tables tpfs106 and tpfs107.

A list of lowest level asset classes and associated percentage amount expressed as a decimal. The total of the percentages for all asset classes must equal 1.

There are separate taxable and tax exempt versions of the portfolios. If the tax exempt version is used, the actual purchases may be in taxable funds depending on whether the client should be using tax exempt funds for that bond duration and whether the type of account in which the purchase is being done permits the use of municipal bonds.

The target portfolio is stored by business area, portfolio number, portfolio tilt, and muni bond use.

Example:

S7	.32
S8	.13
S9	.55

### Investment Assets

**Data Source:** The information for these fields will come from the data entered on the investment assets and retirement plan screens. When the Analysis function is requested, PlanIT will extract this data and load it to the new Rebalancing Assets table. The Rebalancing Assets table will be the source of this data for Auto Rebal.

Note: Asset # needs to be sequentially assigned. This does not correspond to anything within PlanIT. This field is used to identify the asset uniquely to the LP engine. This will be done by the stored procedure which retrieves the data from the data base.

Note: Plan # is a sequentially assigned number to keep asset groupings unique. This will be assigned by the stored procedures which extract the data from the questionnaire at the start of the analysis function.

Note: Hold amount should come from PlanIT to allow part, not all of an asset to be specified as held. This capability is provided because of the need for a cash carve out. This would allow the counselor to specify part of the client's cash balance be retained. The cash asset could then be specified as repositionable and the retained portion would be kept. If there was a cash allocation in the portfolio, the held portion would be used to satisfy this. This partial hold won't work until we go to maybe repositionable assets.

Note: Repositionable flag settings are not valid for PAS. An additional field on the investment and retirement plan entry will be needed to specify this information when PAS is implemented.

A list of all assets to be included in the rebalancing. For each asset, the following information must be provided:

Asset # - Sequentially assigned number to uniquely identify an asset. Additional assets can be returned with the output.

Plan # - A number which identifies the plan to which the asset belongs.

VGI Fund # - The fund number used to identify a Vanguard fund.

VGI Fund Flag - A flag to indicate that the asset is a Vanguard fund.

Title

Current Amount - The current value of the asset in whole dollars.

Hold Amount - The amount of the asset to be retained in whole dollars. For a non-repositionable asset, this would equal the current amount. For a maybe or yes repositionable asset, this can be any amount  $\geq 0$  and  $\leq$  current amount.

Cost Basis - The total cost basis for the asset in whole dollars. If tax cost is unknown, this field should contain nulls.

Fee Amount - The amount in dollars which would be incurred if the asset is sold. Nulls in phase 1.

Loan Amount - For a retirement plan asset, the dollar amount that is not available for repositioning because it is loaned. This amount must be  $\leq$  Current Amount and  $\leq$  Hold Amount.

After Tax Balance - For a retirement plan asset, the dollar amount that represents after tax contributions. This amount must be  $\leq$  Current Amount.

Repositionable Flag - Flag to indicate whether the asset can be repositioned. Choices are:

Yes - definitely sell the asset

No - do not sell the asset

Maybe - asset may be sold to meet the target allocation percentages

Minimum Balance - The minimum amount allowed in this fund. This will be either the retail or retirement minimum, depending on the type of plan to which this account belongs.

Asset Class Breakdown - The asset classes and associate percentages which make up the asset. These asset classes must be at the lowest level of the asset hierarchy. Percentages are expressed as a decimal amount. All percentages must add up to 1. For each asset class, an asset class code and amount must be provided.

Example 1:

S7 1.00

Example 2:

S7 0.60

B2 0.40

If the number of assets retrieved for a plan exceeds the control parameter for maximum assets, exit with an error; auto rebal can not be run.

## Investment Plans

**Data Source:** New PlanIT table, Investment Money Pools. When the Analysis function is requested in PlanIt, PlanIT will extract this data from the existing tables and create the new table.- For retirement plans, most of this data will come from the Retirement Plan entry screen.

Note: Plan # is a sequentially assigned number to keep asset groupings unique. For retirement plans, this could be the plan # (1,2, etc.) identified on the entry screen. However, there also must be dummy plans created for any ownership type defined for the investment assets. e.g. a plan would be created for joint/spouse and a separate plan for the husband's individual accounts. The stored procedure which extracts this data into the Investment Money Pool table will assign the pool #.

A list of all plans to which the investment assets belong. A plan is a grouping of assets by owner and account type. For example, it could represent all of the assets owned jointly with the spouse or a husband's IRA accounts. It is not an individual account or registration.

For each plan, the following data must be supplied:

Plan # - Sequentially assigned number to uniquely identify a plan. Limited to 99 (existing plus any that would be added due to repositioning an existing plan to a different type).

Type - For retirement plans, this is the type of plan. Available choices are: 401(K), 403(B), 457, Qualified Annuity, Non-qualified Annuity, ESOP, KEOGH, Money Purchase Plan, Profit Sharing, Roth IRA, SARSEP, SEP IRA, SIMPLE IRA, Stock Bonus, Traditional IRA, and Rollover IRA. For non-retirement plans (taxable), this will contain spaces.

Owner - The owner of the plan.

Reposition To Plan # - The plan # to which the repositioned assets should be moved. If the plan assets are being repositioned within the plan, this field will contain the plan #. Must specify a number which corresponds to one of the supplied plans.

Restricted Investments - A flag to indicate whether the investment choices for the plan are limited. Choices are yes and no.

Tax Status - Taxable or tax deferred.

If the number of plans retrieved exceeds the control parameter for maximum plans, exit with an error; auto rebal can not be performed.

## Primary Fund List

**Data Source:** New Preferred Fund Class, Preferred Funds, and Alternate Funds tables containing preferred and alternate funds.

This is a list of the preferred and alternate funds to be used as investment choices in plans which do not have restricted funds. At least one investment choice should be provided for each asset class in the target portfolio. Each entry in the list should contain the following information:

Asset class

Preferred/alternate (P = preferred, A = alternate)  
 VGI fund number  
 Fund Id  
 Title  
 Minimum Retail Balance  
 Minimum Retirement Balance  
 Split Fund # - A number (0 through 9) used to differentiate between multiple funds when purchases should be split between multiple funds. 0 indicates the buy goes to a single fund.  
 Split Rate - A rate used to specify the portion of an investment that should go to a given fund when the purchase should be split between multiple funds. Maximum amount is 1.00.  
 Format is 9.99. Split rates for the preferred funds for a single asset class must add up to 1.00.

#### Fund List For Tax Efficient Portfolio

**Data Source:** New Preferred Fund Class, Preferred Funds, and Alternate Funds tables containing preferred and alternate funds.

A separate list of preferred funds to be used in taxable accounts if the portfolio tilt is tax efficient. Each entry in the list should contain the following information:

Asset class  
 Preferred/alternate (P = preferred, A = alternate)  
 VGI fund number  
 Fund Id  
 Title  
 Minimum Retail Balance  
 Minimum Retirement Balance  
 Split Fund # - A number (0 through 9) used to differentiate between multiple funds when purchases should be split between multiple funds. 0 indicates the buy goes to a single fund.  
 Split Rate - A rate used to specify the portion of an investment that should go to a given fund when the purchase should be split between multiple funds. Maximum amount is 1.00.  
 Format is 9.99. Split rates for the preferred funds for a single asset class must add up to 1.00.

#### Restricted Investment Plans Fund Selections

**Data Source:** New Master Restricted Investment Alternatives table containing the restricted funds for a plan. The data is stored once in PlanIT for a given plan (e.g. Texaco's 401(K)). However, there can be multiple plans (e.g. husband and wife both belong to Texaco's 401(K) plan) within the data needed by Auto Rebal that point to the same list of restricted funds. The same data would be repeated for each of these plans.

This is a list of the investment choices available to a plan with restricted investment alternatives. For each investment available to a restricted plan, the following information should be provided:

Restricted Plan Id - identifies the restricted plan for which the investments should be used  
 Limited to a maximum of 99.  
 Restricted asset # - A sequentially assigned number to uniquely identify an asset within a plan.  
 Limited to a maximum value of 99.



666090" 00000000

Asset # - Uniquely identifies an asset within the plan alternatives. A sequentially assigned number within the plan which starts at 1 for each plan.

Asset Class Breakdown - The asset classes and associate percentages which make up the asset. These asset classes must be at the lowest level of the asset hierarchy. Percentages are expressed as a decimal amount. All percentages must add up to 1. For each asset class, an asset class code and amount must be provided. Up to 40 asset classes can be specified.

Minimum Retail Balance - The minimum amount that can be in this fund if the account is in a taxable plan.

Minimum Retirement Balance - The minimum amount that can be in this fund if the account is in a non-taxable (retirement) plan.

VGI fund number - only provided for Vanguard funds (may be blank)

VGI Fund Flag - A flag to indicate that a fund is a Vanguard fund.

Fund Id - The id of the fund on the PlanIT data base.

Title

#### Asset Hierarchy

**Data Source:** Data is in TPFS009.

A list of the available asset classes and how they relate to each other. Only investment asset classes should be included in the hierarchy. The top level of the hierarchy must be IV, for investment. Each entry in the list must contain an asset class, a parent asset class, and a flag to indicate whether it should be included in the rebalancing process. An asset class can be included in the hierarchy for defining assets, but rebalancing can be done at a higher level. Holdings in child asset classes would be combined to determine the holdings at the level where rebalancing is done. IV should not appear as an asset class, only as a parent asset class.

Example:

asset class	parent asset class	Rebalancing Level
SA	ST	Y
ST	IV	Y
S2	SA	Y
S7	S2	N
S8	S2	N
S9	S2	N

#### Purchase Hierarchies

**Data Source:** New Purchase Preferences data base table.

The order in which asset classes should be purchased. Separate hierarchies should be provided for the following categories: bonds outside, stocks outside, bonds "inside", stocks inside, Roth, and annuity. Each purchase hierarchy should consist of the complete set of lowest level asset classes which should be purchased, listed in descending preference order. For example, the bonds outside hierarchy would start with bonds but would have stock asset classes listed after the bonds. ("Inside" refers to within a tax sheltered plan.

For example, an IRA.)

For the purpose of investment order, bond groups which split into a choice of taxable or tax exempt must include both sets of asset classes. The actual class used would be based on whether municipals should be purchased for the bond group and the whether the type of account in which the purchase is done offers a municipal selection.

Only asset class would be input to the auto rebalancing process. Description is included in the list for information purposes. Also, some asset classes have not yet been added to the asset hierarchy, so the code is not yet known.

#### Vanguard Funds Not Wanted

**Data Source:** New PlanIT table.

A list of Vanguard fund numbers that the customer does not want to own.

#### Equivalent Asset Class Table

**Data Source:** New PlanIT table. The entire table would be read into storage.

**Asset Group** - The asset group to which an asset class belongs. This code does not need to correspond to any asset class code. It is used simply to group common entries in the table.

**Asset Class Code** - The asset class code which varies depending on some client criteria. For the initial implementation, asset allocations would switch between municipal bond asset classes and taxable bond asset classes depending on whether the client should be using municipal bonds for their portfolio and whether the investment is being done in a taxable account.

**Tax Status** - Indicates whether the investment is taxable or non-taxable. Valid values are TX = taxable, NT = non-taxable.

**Bond Term** - A code to indicate the type of bond. Valid values are HY = high yield, LT = long term IT = intermediate term, ST = short term, and blanks = not applicable.

## **Outputs**

### **Always Returned**

The following data fields are always returned from the auto rebalancing object:

Status - Indicates whether requested function completed successfully. Values are:

<b>Status Code</b>	<b>Meaning</b>
YR	Rebalancing is needed
FS	Rebalancing failed in sell linear programming process
FB	Rebalancing failed in buy linear programming process
FR	Final Report run (set by PlanIT)
SE	Request too large for sell linear programming process
BE	Request too large for buy linear programming process
NR	Rebalancing is not needed
SR	Rebalancing was completed successfully
BR	Bad request code sent
PC	Analysis canceled in PlanIT (set by PlanIT)

Optional Data Returned - Indicates whether optional output data was returned. Choices are yes and no.

For status codes Y or N, no other output data would be provided. For other status codes, rebalancing may have been partially completed.

### **Optional Output**

The following data may or may not be returned. If the optional data returned flag indicates no data was returned, none of this data is returned. If the optional data returned flag indicates data was returned, all types of data will be returned.

### **Investment Assets**

Update the Rebalancing Assets table with this data. For assets that were input, buy amount, sell amount, proposed amount, tax cost, and fee cost fields would be updated. For new assets, added by the rebalancing process, a new row containing the fields shown would be added to the table.

A list of all assets after rebalancing. All input assets will be returned, followed by the assets added by the rebalancing process. For each asset, the following information must be provided:

Asset # - Sequentially assigned number to uniquely identify an asset. For assets which were input, this is the number supplied. For new assets, this is a sequentially assigned number beginning with the last number used on an input asset + 1.

Plan # - A number which identifies the plan to which the asset belongs.

Asset Class Breakdown - The asset classes and associate percentages which make up the asset.

VGI Fund # - The fund number used to identify a Vanguard fund. (May be blank).

VGI Fund Flag - A flag to indicate that the investment is a Vanguard fund.

Title - Fund name or description of an individual stock or bond. .

Current Amount - The current value of the asset in whole dollars. For input assets, this is the amount which was supplied. For new assets, this field would contain zeros.

Buy Amount - The amount of the asset which should be purchased.

Sell Amount - The amount of the asset which should be sold.

Proposed Amount - The amount of the asset which should be held in the proposed portfolio.  $\text{Current amount} + \text{buy amount} - \text{sell amount} = \text{proposed amount}$ .

#### Explanations

Update the new Explanations table in the PlanIT data base, adding a row for each message created.

Text messages explaining why different rebalancing decisions were made.

### **Work Fields Which Must Be Accessible By Multiple Modules Within The Auto Rebal Object**

This section defines work data fields which are needed by the Auto Rebal Object. These fields are temporary storage areas for information which exist only for the instance of the Auto Rebal Object. These fields are created and populated by the Auto Rebal Object. When the object completes, the work fields should cease to exist. The contents are unique to a given instance of the Auto Rebal Object.

Asset Gain Amount - Dollar amount gained on an asset since it was purchased. This amount may be an estimate. Created by Develop Gain/Loss For Each Input Asset.

Asset Loss Amount - Dollar amount lost on an asset since it was purchased. This amount may be an estimate. Created by Develop Gain/Loss For Each Input Asset.

Last Used Asset # - Highest asset number currently assigned to an asset. This number is used to assign a unique identifier to any asset added to the portfolio during rebalancing. Created By Initialize Output Investment Assets.

Model File - A sequential file of equations to be used by the LP processing engine to determine the asset classes in which purchases should be done.

Alternate Asset Class Table - This table identifies the taxable asset class codes and percentages to be used for a tax exempt class when the tax exempt class is not applicable. Each row of the table will have the following data fields:

Tax Exempt Bond Class - The tax exempt asset class code which may be replaced by the taxable alternative.

Amount Moved To Taxable Class - The amount of money reallocated from the desired tax exempt asset class to the alternative taxable class.

Alternate Class Count - The count of the alternate taxable asset classes which should be used in place of the Tax Exempt Bond Class. No entry should have an alternate class count < 1.

Alternate Class Array - An array of the alternate taxable asset classes. The number of entries in the array corresponds to the Alternate Class Count. Each entry in the array has the following fields:

Asset Class - A taxable asset class code.

Asset Class Percent - The percentage, expressed as a decimal value, of the total portfolio represented by the asset class code. A value of 10% would be stored as .10.

*Note: Logic within the Auto Rebal Object will look for values in this table even when it may not have been created. It will need to either be able to recognize an "empty" table or have a flag to say the table can not be checked.*

### **Main Control**

IF request is equal to "is rebal needed"

    Perform Is Rebalance Needed? *(Is Rebalance Needed? must have access to all input data passed by the calling program.)*

    Return to the calling program with Status = status returned by the called process and Optional Data Returned Flag = NO

ELSE

IF request is equal to "rebalance" or "rebalance if needed"

    Perform Is Rebal Needed

    IF "rebalance" or Status = YR

        Perform Rebalance Portfolio *(Process defined in a separate document. The called process must have access to all data passed to this module and will create the output data if it is successful.)*

        Return to the calling program with Status and Optional Data Returned Flag = values returned by the called process.

    ELSE

        Return to the calling program with Status = status returned by the called process and Optional Data Returned Flag = NO

    END\_IF

ELSE

    Return to the calling program with Status = BR and Optional Data Returned Flag = NO.

END\_IF

### **Is Rebal Needed?**

Get Target Portfolio Allocation Rates

IF Use Muni Bonds For High Yield Bonds = yes

    or Use Muni Bonds For Long Term Bonds = yes

    or Use Muni Bonds For Intermediate Term Bonds = yes

    or Use Muni Bonds For Short Term Bonds = yes

    Perform Get Taxable Bond Class Allocations (defined in Rebalance Portfolio)

    Perform Determine Taxable Bond Allocation (defined in Rebalance Portfolio)

    Perform Switch Target Portfolio Allocations (defined in Rebalance Portfolio)

END\_IF

Develop Current Portfolio Amounts

Develop Target Portfolio Amounts

Develop Adjusted Target Amounts

Go through all Investment Assets.

IF at least one investment asset has a Repositionable Flag of YES or MAYBE

    IF PAS and periodic review

        Initialize Status to NR

Locate each of the SAA sub-totals created in the Develop Current Portfolio Amounts and do the following:

Locate the corresponding SAA target in the Adjusted Target Portfolio

If the SAA amount in the current portfolio < [ (1 - m\_SAAPeriodicVarianceMinus) \* SAA adjusted target amount ] rounded based on m\_RoundingTo  
OR SAA amount in the current portfolio > [(1 + m\_SAAPeriodicVariancePlus) \* SAA adjusted target amount] rounded based on m\_RoundingTo.

Set Status to YR

END\_IF

When all SAA amounts have been checked, return the Status

ELSE

Return Status = YR

END\_IF

ELSE

Return Status = NR

END\_IF

#### **Get Target Portfolio Allocation Rates**

IF Use Muni Bonds For High Yield Bonds = Yes

or Use Muni Bonds For Long Term Bonds = Yes

or Use Muni Bonds For Intermediate Term Bonds = Yes

or Use Muni Bonds For Short Term Bonds = Yes

set Tax Status = NT

ELSE

set Tax Status = TX

END\_IF

Call stored procedure Retrieve Target Portfolio to retrieve the allocations from the data base. Use the Portfolio Number, m\_PortfolioTilt, tax bracket = HI, and tax status determined above as the key values passed to the stored procedure.

#### **Develop Current Portfolio Amounts**

For each input asset create/update a sub-asset class total for the portfolio for current amount and hold amount:

Zero current amount and hold amount accumulator fields for the asset.

For asset class (a) associated with the asset for a=1 to a=n-1:

Compute work asset amount = current amount (a) \* asset class percent (a) rounded to the nearest 100.

Compute work hold amount = hold amount (a)/current amount (a) \* asset class percent (a) rounded to the nearest 100.

Current amount accumulator = current amount accumulator + work asset amount.

Current hold amount accumulator = current hold amount accumulator + work hold amount.

Locate asset class totals for asset class (a)

IF total is found, add work asset amount to asset class total-current amount, add work hold amount to asset class total-hold amount

ELSE

create an asset class total area for asset class (a) with asset class total-current amount = work asset amount and asset class total-hold amount = work hold amount

END\_IF

For asset class (a) associated with the asset for a=n:

Work asset amount = current amount (a) - current amount accumulator.

Work hold amount = hold amount (a) - current hold amount - hold amount accumulator.

Locate asset class totals for asset class (a)

IF total is found, add work asset amount to asset class total-current amount, add work hold amount to asset class total-hold amount

ELSE

create an asset class total area for asset class (a) with asset class total-current amount = work asset amount and asset class total-hold amount = work hold amount

END\_IF

Develop sub-total for higher level asset classes and SAA's:

For each asset class total created, find the parent asset class.

IF the parent class is not = IV, locate the sub-totals for this parent class

IF the sub-totals are found, add the asset class total for the current amount and hold amount to the corresponding sub-total fields

ELSE create the sub-total for the parent asset class with the sub-total amounts for current amount and hold amount equal to the values from the asset class total

END\_IF

Keep going up the asset hierarchy for the current asset sub-total until the asset class with IV for the parent is located. Then go on to process the next asset class total.

END\_IF

### Develop Target Portfolio Amounts

- Go through each asset class in the target portfolio, provided as input, to identify all the parent classes up to the SAA level (SAA is the class for which the parent class is IV).
- Get sub-total percentages for each SAA and sub-asset class grouping.
- Work through the target portfolio, following the asset hierarchy from higher to lower levels, to develop target amounts for each category. (i.e. First level for which targets are calculated will be the SAA.)
  - For all entries within the level, except the last, target allocation amount = (target percentage / sum of the target percentages for the hierarchy grouping) \* the allocation at the higher level of the asset hierarchy. Round the result to the nearest dollar or hundred dollar depending on the value of the input rounding parameter.
  - For the last item within a hierarchy grouping, the target allocation amount = (total amount for the category - the sum of the target allocation amounts for the other items within the category).



Example:

SAA allocations are 10% cash reserves, 80% bonds, 10% stocks. Bond allocations are 8% intermediate term, and 72% short term. The rounding parameter is round to the nearest \$100. Total portfolio amount is \$500,150.

SAA allocations:

Cash reserves =  $(.1 / 1) * 500,150 = 50,015$  which rounds to 50,000

Bonds =  $(.8 / 1) * 500,150 = 400,120$  which rounds to 400,100

Stocks =  $500,150 - (50,000 + 400,100) = 50,050$

Bond allocations:

Intermediate Term =  $(.08 / .8) * 400,100 = 40,010$  which rounds to 40,000

Short Term =  $400,100 - 40,000 = 360,100$

### Develop Adjusted Target Amounts

Working from higher to lower levels within the asset hierarchy, determine adjusted target amount for each of the asset categories and sub-totals.

#### SAA Targets

- Initialize adjustment needed to zero.
- Repeat for each SAA within the target portfolio.

IF hold amount for the SAA in the current portfolio exceeds the target amount

Adjusted target amount = hold amount for the class in the SAA.

IF Produce Explanations = yes

Record an explanation that target amount was adjusted due to non-repositionable assets.

END\_IF

Add (hold amount for the class - target amount for the class) to adjustment needed.

ELSE

Adjusted target amount for the class = target amount for the class

END\_IF

- Repeat for each SAA within the current portfolio:

IF class in the current portfolio is not in the target portfolio

Add the class to the adjusted target portfolio. Adjusted target amount = hold amount from the current portfolio.

IF Produce Explanations = yes

Record an explanation that the target amount of zero was adjusted due to non-repositionable assets.

END\_IF

Add the hold amount for the class to adjustment needed.

END\_IF

- If adjustment needed > 0, spread among other asset classes at the same level of the hierarchy based on the ratio of the asset class to the other asset classes which can be adjusted. Set Explanation Recorded Flag to NO. Repeat the following process until adjustment needed = 0:

- Adjustment applied = 0.

- Get the sum of the percentages for all adjusted target portfolio SAA entries where the adjusted target amount is greater than the hold amount for the class.

- Repeat for all SAA entries in the target portfolio:

IF adjusted target amount > hold amount for the class

Adjustment amount = (target % for the class/sum of percentages obtained earlier) \*  
adjustment needed. The result is rounded to the nearest dollar or hundred dollars based  
on the rounding parameter.

Adjustment remaining = (adjustment needed - adjustment applied)

IF adjustment remaining < \$100

Adjustment amount = adjustment remaining

END\_IF

IF adjustment amount > (adjusted target amount - hold amount for the class)

adjustment amount = (adjusted target amount - hold amount for the class)

END\_IF

Adjusted target amount = (adjusted target amount - adjustment amount)

Add adjustment amount to adjustment applied.

IF Explanation Recorded Flag = NO

IF Produce Explanations = yes

Record an explanation that the target was adjusted due to non-repositionable assets  
in another asset class.

END\_IF

END\_IF

END\_IF

- Adjustment needed = (adjustment needed - adjustment applied). Adjustment applied = 0.

- Explanation Recorded Flag = YES

Example:

	Target Amount	Non-Repo Asset Amount	Current Amount
Cash	50,000	51,000	60,000
Bonds	400,100	0	50,000
Stocks	50,050	0	390,150

Adjusted cash target = 51,000

Adjusted cash minimum = 50,000

Adjusted cash maximum = 52,500

Adjustment to spread = 51,000 - 50,000 = 1,000

Bond adjustment = (.8 / .9) \* 1,000 = 889 which rounds to 900

Stock adjustment = 1000 - 900 = 100

Adjusted bond target = 400,100 - 900 = 399,200

Adjusted bond minimum = 391,200

Adjusted bond maximum = 411,200

Adjusted stock target = 50,050 - 100 = 49,950

Adjusted stock minimum = 49,000

Adjusted stock maximum = 51,400

Variance = current amount - adjusted target amount

Cash variance = 60,000 - 51,000 = +9,000

Bond variance = 50,000 - 399,200 = -349,200

Stock variance = 390,150 - 49,950 = +340,200

#### Non-Stock Sub-asset Categories

For SAA's other than stock,<sup>3</sup> continue working down the asset hierarchy to calculate the amounts for each asset class at that level in the same way as described for the SAA's. The amount to be allocated at each sub-level is the amount allocated at the prior level. The percentage weighting for each asset class within the group is the percentage assigned to that group divided by the sum of the percentages in the group.

#### Stock Sub-asset Categories

The allocations for the first level of the stock SAA is different than other SAA groups. The process to be done is as follows:

- The allocation for the foreign stocks (S0 asset category) is the target amount calculated previously.

IF foreign target amount > adjusted target stock SAA amount

S0 adjusted target allocation = adjusted target SAA amount

IF Produce Explanations = yes

Record an explanation that the foreign allocation was reduced due to non-repositionable assets in other asset classes.

END\_IF

END\_IF

The intent is to try to allocate the entire desired foreign allocation, regardless of the other stock holdings.

- US stock allocation = (adjusted stock SAA target amount - S0 adjusted target allocation)

---

<sup>3</sup> Stock investments are part of SAA ST.

- IF (hold amount for stock SAA - hold amount for S0 asset class) > US stock allocation  
     US stock allocation = (hold amount for stock SAA - hold amount for S0 asset class)  
     S0 adjusted target allocation = (stock SAA adjusted target allocation - revised US stock allocation)  
     IF Produce Explanations = yes  
         Record an explanation of the change to the foreign allocation.  
     END\_IF  
 END\_IF
- Within the foreign stock asset class, calculate the group breakdowns for lower asset levels in the same manner as described previously for the SAA's
- For the US stocks group, determine the current non-repositionable amount in "other" US stocks. This would be the amount in any asset groups other than large US (asset class S2) and mid/small US (asset class S3). (The amount would currently be the amount of individual stock holdings. However, the process should not assume this to allow for other asset classes which Vanguard will not include in the target portfolio to be added to the hierarchy.)  
  
     Add this allocation amount to the adjusted target portfolio by copying the various asset groups which comprise it from the current portfolio. The allocation amount for each class within this group would be only the hold amount for the class.
- IF the "other" stock allocation amount > 0  
     US target allocation amount = (US target allocation amount - "other" stock allocation amount)  
     IF Produce Explanations = yes  
         Record an explanation that the US stock allocation was reduced due to non-repositionable holdings in other stocks.  
     END\_IF  
 END\_IF
- The resulting US stock target allocation amount is the total to be split between the large US (S2) and mid/small US asset groups (S3). The allocation between these two groups should be done as previously described for the SAA and other asset groups.
- Sub-class breakdowns for large US and mid/small US are done in the same manner as for other asset classes.

#### Example 1

Stock SAA adjusted target allocation = \$50,000

Stock SAA hold amount = \$30,000

S0 target % = .06

S0 hold amount = \$3,000

Total portfolio value = \$900,000

S1 (individual stocks) hold amount = \$5,000

S0 adjusted target allocation = .06 \* 900000 = 54000

S0 adjusted target allocation is greater than the stock SAA target allocation, so S0 adjusted target allocation = 50,000

US stock allocation = (stock SAA adjusted target allocation - S0 adjusted target allocation) = (50000 - 50000) = 0

US stock allocation < (stock SAA hold amount of 30000 - S0 hold amount of 3000), so the US stock allocation is changed to the difference between the two amounts, \$27,000.

S0 adjusted target allocation = (stock SAA adjusted target allocation - US stock allocation) = (50000 - 27000) = 23000.

### Example 2

Stock SAA adjusted target allocation = \$50,000

Stock SAA hold amount = \$6,000

S0 target % = .06

S0 hold amount = \$3,000

Total portfolio value = \$300,000

S1 (individual stocks) hold amount = \$1,500

S2 (large US stocks) % = .32

S2 hold amount = \$1,500

S3 (mid/small US stocks) % = .13

S0 adjusted target allocation = .06 \* 300000 = 18000

S0 adjusted target allocation is less than the stock SAA target allocation, so S0 adjusted target allocation is not changed.

US stock allocation = (stock SAA adjusted target allocation - S0 adjusted target allocation) = (50000 - 18000) = 32000

US stock allocation > (stock SAA hold amount of 6000 - S0 hold amount of 3000), so the US stock allocation is unchanged

US stock allocation = (US stock allocation - "other" stock hold amount) = (32000 - 1500) = 30,500

Total group percent = S2% + S3% = .32 + .13 = .45

S2 adjusted target allocation = (S2% / total group %) \* US stock allocation = (.32 / .45) \* 30500 = 10844. Rounded to the nearest \$100, S2 adjusted target allocation = 10800.

S3 adjusted target allocation is the last allocation of the group, so S3 adjusted target allocation = (US stock allocation - S2 adjusted target allocation) = (30500 - 10800) = 19700.

B. Rebalance Portfolio.doc - Auto Rebal Object - Rebalance Portfolio

**Inputs**

This module must have access to all input passed to the Auto Rebal Object. This data is defined in Auto Rebal Object.doc.

**Outputs**

This module must be able to populate all data identified for the Auto Rebal Object. This data is defined in Auto Rebal Object.doc

## **Main Flow**

Initialize Status to SR

Review all input assets

IF there is any maybe repositionable assets

    Develop Gain/Loss For Each Input Asset *(Creates a gain and a loss amount for each input asset.  
    These fields must be accessible by other routines.)*

    Perform Determine How Much Of Each Current Asset To Sell And/Or Hold

END\_IF

IF Status = SR

    Perform Determine How To Invest Proceeds From Asset Sales (defined in Determine Investments.doc)

END\_IF

Return to the calling module with Status, Optional Data Returned Flag, and optional data fields populated by the called modules.

## **Develop Gain/Loss For Each Input Asset**

For each investment asset, determine a gain amount and a loss amount.

IF plan to which the asset belongs is tax exempt

    work cost = Current Amount

ELSE

    IF Cost Basis Flag = "not known"

        IF Estimate Tax Cost = Y

            Compute work cost = (Current Amount \* Estimate Tax Cost Asset %). The result  
            should be rounded to the nearest dollar or \$100 based on m\_RoundingTo.

        ELSE

            work cost = 0

        END\_IF

    ELSE

        work cost = Cost Basis

    END\_IF

END\_IF

IF work cost < current asset value

    asset loss amount = 0

    asset gain amount = current asset value - work cost

ELSE

    IF work cost > current asset value

        asset gain amount = 0

        asset loss amount = work cost - current asset value

    ELSE

```

        asset gain amount = 0
        asset loss amount = 0
    END_IF
END_IF

```

### **Get Taxable Bond Class Allocations**

*This routine gets an alternate set of target portfolio allocations. This alternate set is the version which uses taxable bonds. This version is required since a client may not be using municipal bonds for all classes of bonds or may be buying bonds in a plan type which does not allow municipal bonds and will therefore need to allocate the bond purchase in the same manner as done for the taxable portfolio.*

*In these situations, the allocation for a bond class (short term, intermediate term, etc.) would remain the same as in the municipal bond version of the portfolio. However, investments would be done using the taxable asset class. In some cases, this change will just be a switch of asset class code. In others, the taxable investment is split between multiple asset class codes (e.g. active and passive investments). In this situation, the class allocation will remain the same as in the municipal portfolio, but will be split in the same ratio as for the taxable allocations.*

Use stored procedure Retrieve Target Portfolio to retrieve the alternate target portfolio percentages. Use Portfolio Number, m\_PortfolioTilt, tax bracket = HI, and tax status = TX as the keys passed to the procedure. Store the returned asset class codes and associated percentages as an alternate target portfolio.

### **Determine Taxable Bond Allocation**

*This procedure determines the taxable allocation to be used for a municipal bond allocation in the target portfolio. This alternate allocation may be used for all investments in the bond class or for investments in the class when the tax exempt investment is not appropriate.*

For each asset class in the target portfolio, do the following:

Match the asset class code from the target portfolio to the asset class codes in the Equivalent Asset Class Table.

IF there is a match and the Tax Status for the matching table entry is NT (non-taxable)

Look for the taxable alternate class in the Equivalent Asset Class Table, using the Asset Group from the matching entry and Tax Status of TX (taxable) as keys.

IF a match is found

Search for the Asset Class from the new matching entry in the alternate target portfolio

If the Asset Class is in the alternate target portfolio, it is a substitution for the existing target portfolio asset class

Create an entry in the Alternate Asset Class Table with the following values:



Tax Exempt Bond Class = Asset Class from the target portfolio which started this process  
 Amount Moved To Taxable Class = 0  
 Alternate Class Count = 1  
 One Alternate Class Array entry with the Asset Class = Asset Class from the new matching entry and Asset Percent = the percent for the Asset Class entry in the target portfolio

ELSE

Locate all child asset classes within the asset hierarchy for the Asset Class of the new matching entry.

IF there are no child classes or any is marked as not included in rebalancing go on to check the next asset class entry in the target portfolio

ELSE

For each child class, do the following:

Search for the child class in the alternate target portfolio.

If the child class is in the alternate target portfolio

IF first matching child

Create an entry in the Alternate Asset Class Table with the following values:

Tax Exempt Bond Class = Asset Class from the target portfolio which started this process

Amount Moved To Taxable Class = 0

Alternate Class Count = 1

One Alternate Class Array entry with the Asset Class = Asset Class from the new matching entry and Asset Percent = the percent for the Asset Class entry in the alternate target portfolio

ELSE

Update the existing entry in the Alternate Asset Class Table for the Tax Exempt Bond Class = Asset Class from the target portfolio which started this process. Do the following:

Add 1 to Alternate Class Count

Add an additional Alternate Class Array entry with the Asset Class = child class and Asset Percent = the percent for the child class entry in the alternate target portfolio

END\_IF

ELSE

Locate and children of the child class being processed in the asset hierarchy and add these additional children to the list of child asset classes to be checked.

END\_IF

When all child classes have been checked,

IF an Alternate Asset Class Table entry was created for the Asset Class from the target portfolio which originally started this process

Adjust the Asset Percents for the entries in the Alternate Class Array by doing the following:

Compute Percent Total = Sum the asset percents for all entries in the Alternate Class Array.

Compute the adjusted Asset Percent for each entry = (Asset Percent / Percent Total) \* percent for the Tax Exempt Bond Class in the target

portfolio. Round the percents as needed. However, insure that the sum of the entries in the array = the percent for the Tax Exempt Bond Class in the target portfolio.

```
ELSE
    go on to process the next asset class in the target portfolio
END_IF
END_IF
END_IF
ELSE
    go on to check the next asset class entry in the target portfolio
END_IF
ELSE
    go to check the next asset class in the target portfolio
END_IF
```

### **Switch Target Portfolio Allocations**

*If the portfolio to be used for the client is the municipal bond version, but the client should not be using municipal bonds for a given bond class, this procedure will switch the target allocations to reflect the asset class codes and percentages from the taxable version of the portfolio.*

For each asset class in the target portfolio, do the following:

Search the Equivalent Asset Class table for a match on Asset Class and Tax Status of NT (non-taxable).

IF a match is found

Check the Use Municipal Bond For flag which corresponds to the Bond Term of the matching entry (e.g. IF the Bond Term is ST (short term), check the Use Municipal Bonds For Short Term Bonds flag.)

IF there is a corresponding flag and the value is No

Search the Alternate Asset Class Table for a match on the asset class from the target portfolio to the Tax Exempt Bond Class

IF a match is found

Delete the asset class entry from the target portfolio

Add a new entry to the target portfolio for each entry in the Alternate Class Array of the matching Alternate Asset Class Table entry.

ELSE

go on to the next asset class in the target portfolio

END\_IF

ELSE

go on to the next asset class in the target portfolio

END\_IF

ELSE

go on to the next entry in the target portfolio

END\_IF

- C. Determine Investments.doc - Auto Rebal Object - Determine How to Invest Proceeds From Asset Sales

**Constants Needed By Module**

Required Buy Variables - The count of variables which will always be present in a "buy" model. Current value is 5.

Required Buy Constraints - The count of constraint equations which will always be present in a "buy" model. Current value is 8.

Maximum Variables - The maximum number of variables which can be in the linear programming model with the current version of the LP processing engine. 16,000 for the industrial version of LINDO.

Maximum Constraints - The maximum number of constraint equations which can be in the linear programming model with the current version of the LP processing engine. 8,000 for the industrial version of LINDO.

## **Work Fields For Module**

This section identifies major work fields which are used in multiple routines within this portion of the Auto Rebal Object.

**Asset Class Buy Control Table** - This table is used to collect information regarding how buys are to be handled for a given asset class. There will be a maximum of one entry for each asset class in the target portfolio for which there is at least one non-zero adjusted buy variable. Each entry will contain the following data elements:

**Asset Class** - The asset class from the target portfolio. This is the asset class for which buy variables are defined.

**Taxable Buy Amount** - The total adjusted buy amounts for the asset class in taxable plans.

**Tax Deferred Buy Amount** - The total adjusted buy amounts for the asset class in tax deferred plans.

**Split Taxable Buy Flag** - Yes/No flag to indicate whether the buys in taxable accounts should be split between multiple funds.

**Split Tax Deferred Buy Flag** - Yes/No flag to indicate whether the buys in tax deferred accounts should be split between multiple funds.

**Taxable Preferred Fund Found Flag** - Yes/No flag to indicate whether a preferred fund(s) was found for use in the taxable accounts.

**Tax Deferred Preferred Fund Found Flag** - Yes/No flag to indicate whether a preferred fund(s) was found for use in the tax deferred accounts.

**Taxable Preferred Fund Count** - The number of preferred funds for the asset class for use in taxable accounts.

**Tax Deferred Preferred Fund Count** - The number of preferred funds for the asset class for use in tax deferred accounts.

**Buy Amount Work Fields** - The following fields are used for processing the buys within an asset class. There are nine occurrences of each field, to allow an asset class investment to be split between a maximum of nine funds. There are separate fields for taxable and tax deferred accounts to allow for different fund splits in the different tax status accounts. For most portfolios/asset classes, the investment split is done in the same manner for both taxable and tax deferred funds. For these situations, only the taxable fields will be used.

**Taxable Split Amount** - The amount to be bought in taxable accounts for split fund # (n).

**Taxable Split Rate** - The allocation rate for taxable accounts for split fund # (n). Maximum value is 1.00. Format is 9.99.

**Taxable Fund #** - The VGI fund to be used for split fund # (n).

**Taxable Fund Holdings** - The total existing taxable holdings in split fund (n) which have not been repositioned.

**Tax Deferred Split Amount** - The amount to be bought in tax deferred accounts for split fund # (n).

Tax Deferred Split Rate - The allocation rate for taxable accounts for split fund # (n). Maximum value is 1.00. Format is 9.99.

Tax Deferred Fund # - The VGI fund to be used for split fund # (n).

Tax Deferred Fund Holdings - The total existing tax deferred holdings in split fund (n) which have not been repositioned.

## Main Control

Execute Create Purchase Fund Lists

Execute Build Formulas For Buy Model

IF Status = SR

    Call LP processing engine with Model File as input

        IF LP processing engine status is successful

            Execute Determine Funds To Buy

            Execute Buy Fund Adjustments

            Execute Buy Cleanup

        END\_IF

END\_IF

Return to caller with status and output data.

## Create Purchase Fund Lists

*Get the preferred funds for the taxable plans.*

Set up the data base keys to use:

    Business area will be based on the setting of m\_BusinessArea

    Portfolio number will be the value from Portfolio Number

    Portfolio Tilt = value of m\_PortfolioTilt

    Rank = preferred

    Bond Return Flag - set as follows:

        IF Use Muni Bonds For Long Term Bonds = yes or Use Muni Bonds for High Yield Bonds = Yes

            or Use Muni Bonds For Intermediate Term Bonds = Yes or Use Muni Bonds For Short  
            Term Bonds = Yes

        Bond Return Flag = BO (both)

    ELSE

        Bond Return Flag = TX (taxable only)

    END\_IF

    State = value from m\_LegalResidenceState

Call stored procedure to Get Preferred and Alternate Funds

IF count of retrieved rows = 0

    IF Produce Explanation = yes

        Record the explanation "No preferred funds found for the portfolio"

    END\_IF

ELSE

    For each row retrieved, perform Add A Fund List Entry

END\_IF

*Get the preferred funds for the tax deferred plans. (This only needs to be done when using the tax efficient portfolio.)*

IF m\_PortfolioTilt = TE (tax efficient)

Set up the data base keys to use:

Business area will be based on the setting of m\_BusinessArea

Portfolio number will be the value from Portfolio Number

Portfolio Tilt = NO (core)

Rank = preferred

Bond Return Flag - set as follows:

IF Use Muni Bonds For Long Term Bonds = yes or Use Muni Bonds for High Yield Bonds =

Yes or Use Muni Bonds For Intermediate Term Bonds = Yes or Use Muni Bonds

For Short Term Bonds = Yes

Bond Return Flag = BO (both)

ELSE

Bond Return Flag = TX (taxable)

END\_IF

State = value from m\_LegalResidenceState

Call stored procedure Get Preferred Funds

IF count of retrieved entries = 0

IF Produce Explanations = yes

Record the explanation "No preferred funds found for the portfolio"

END\_IF

ELSE

For each row retrieved, perform Add A Fund List Entry

END\_IF

END\_IF

Call the stored procedure to retrieve replacement funds. For each replacement fund, the fund id, VGI fund #, title, retail minimum, retirement minimum, and asset class breakdown will be returned. If the fund is not already in the set of purchase alternatives, add it. For new adds, the rank should be set to R, target asset class to spaces, split fund number = 0, and split fund percent = 1.00.

#### **Add A Fund List Entry**

Format an entry as follows:

Asset Class = Search Asset Class

Preferred/Alternate = Search Rank

Split Fund # = split fund # from the data base row

Split Fund Rate = investment rate from the data base row

VGI Fund Number = fund number from the data base row  
 IF Search Rank = Preferred  
   IF m\_PortfolioTilt = TE (tax efficient)  
     Add the formatted entry to the Fund List For Tax Efficient Portfolio.  
   ELSE  
     Add the formatted entry to the Primary Fund List.  
   END\_IF  
 ELSE  
   Add the formatted entry to the Primary Fund List.  
 END\_IF

### **Build Equations For Buy Model**

#### **Naming Conventions For Variables**

C\_xx - Current value of holdings in an asset class which are not being repositioned. xx is the asset class.

Bn\_xx - An amount to be purchased in an asset class within a given plan. N is the plan # which identifies a specific plan. xx is the asset class.

H\_xx - The total holdings in an asset class. This includes the current holdings in the asset class, plus any purchases in the asset class, plus the holdings in any child asset classes. xx is the asset class.

V\_xx\_M & V\_xx\_P - Plus and minus variances which, when added to and subtracted from the total holdings in the asset class, make the result equal to the target for that asset class. Two variables are used so that the variance amounts are always positive. Only one variance in a pair would be non-zero at a time. xx is the asset class.

assetvar - The sum of all V\_xx\_M and V\_xx\_P variables at the lowest level of the asset hierarchy.

SAAVar - The sum of the V\_xx\_M and V\_xx\_P variables for asset classes which are children of the IV class and are represented in the target portfolio (i.e. at least one of the target asset classes adds into the SAA asset class).

InterVar - The sum of the V\_xx\_M and V\_xx\_P variables for asset classes which are children of the SAA asset classes included in the SAAVar amount and are parents of other asset classes.

USStkVar - The sum of the V\_xx\_M and V\_xx\_P for the S2 and S3 asset classes. These asset classes make up the US stock amount for the target portfolio.

Bad\_xx - The total purchases done for an asset class which are in plans which are not preferred selections for the asset class. The preferred plan is one that already has the asset class and is invested in the preferred or an alternate fund for that class. The "bad" plans are any plans which can purchase the asset class and don't own the preferred or alternate fund for the class. xx is the asset class.

AddPurch - The sum of the Bad\_xx variables.

- Create a sequential file to hold the equations for the model. This file will be referred to as Model File in the remainder of this section.



- Write the following constant equations to Model File. These define the goal function and set up for the constraint equations which will follow.

Min assetvar+intervar+USstkvar+SAavar+.05addpurch  
subject to

- Create an additional purchase asset table to hold information on existing Vanguard accounts in preferred or alternate funds. Each entry should contain asset class code, taxable/non-taxable plan indicator, plan type, and to plan #. Go through the input assets and do the following:

IF asset class percent (1) for the asset = 100% *(only want assets that are not balanced funds)*  
and the fund is a Vanguard fund  
and current plan # is equal to Reposition To Plan # *(only want assets that are in a destination plan)*

Locate asset class (1) in target portfolio *(If the asset class for the asset is not included in rebalancing, find its first ancestor which is and use this class to check the target portfolio. This ancestor class would be the one added to the table if the class is in the target portfolio.)*

IF asset class is found in the target portfolio *(Asset class would be considered in the portfolio if it is an exact match to a target portfolio asset class or the asset class matches an alternate asset class entry for a tax exempt bond class which is in the target portfolio.)*

IF the asset is in a VGI annuity  
or VGI fund # matches a preferred or alternate fund # <sup>1</sup>

Add the information for the asset to the table. (For alternate asset classes where the alternate classes are children of the class which is the taxable alternate to a non-taxable class, put the parent class, not the children into the list of classes to be purchased.)

END\_IF

END\_IF

END\_IF

<sup>1</sup>Either the Primary Fund List or Fund List For Tax Efficient Portfolio should be searched. Do the following to determine which list of funds to check for preferred or alternate funds:

IF m\_PortfolioTilt = T (tax efficient) and the Plan is tax-deferred  
use the Fund List For Tax Efficient Portfolio

ELSE

use the Primary Fund List

END\_IF

- Create a table of accumulators for hold amounts and adjusted target amounts for each asset class included in rebalancing. Each table entry should have an asset class code, an adjusted target amount, and a hold amount. There should be one entry for each asset class code in the asset hierarchy ,

including all summary classes (IV included). The hold and adjusted target amounts should all be initialized to zero.

- Go through all input assets and add the hold amounts to the hold amounts in the table just created.

IF hold amount for the input asset > 0

Hold amount used = 0

For asset class (a) associated with the input asset for a=1 to a=n-1:

Compute work hold amount = hold amount (a) \* asset class percent (a). The result is rounded to the nearest \$100 or \$1 depending on m\_RoundingTo.

Locate asset class (a) in the accumulator table.

IF asset class (a) is found in the table

Add work hold amount to the hold amount for the corresponding table entry

ELSE

Locate asset class = IV in the accumulator table

Add work hold amount to the hold amount for the blank asset class table entry

END\_IF

Add work hold amount to hold amount used.

For asset class (a) associated with the input asset for a=n:

Compute work hold amount = hold amount (a) - hold amount used.

Locate asset class (a) in the accumulator table.

IF asset class (a) is found in the table

Add work hold amount to the hold amount for the corresponding table entry

ELSE

Locate asset class = IV in the accumulator table

Add work hold amount to the hold amount for the IV table entry

END\_IF

END\_IF

- Summarize hold amounts in the table entries for all asset classes which are not included in rebalancing. Store summarized amounts at the first ancestor which is included in rebalancing.
- Develop the adjusted target amounts for each level of the asset hierarchy and update the table of adjusted target amounts.

Start at the bottom level of the hierarchy. If the asset class is not included in rebalancing, the target amount is zero. If the asset class is included in rebalancing and it is in the adjusted target portfolio, the target amount from the target portfolio is the target amount for the asset class. If the asset class is included in rebalancing but is not in the adjusted target portfolio, the target amount is zero.

For each level above the lowest level at which rebalancing begins, the adjusted target amount is the sum of the child asset class adjusted target amounts, plus any hold amount for that class. Work up the hierarchy until adjusted targets have been developed for all classes, up to IV. For the IV class, the adjusted target amount is the total portfolio value.

- For each entry in the accumulator table which is included in rebalancing, write an equation to Model File to identify the amount held in each asset class. This is the amount which is not being repositioned. Format the equation as  $C_{xx} = \text{hold amount for the table entry}$  (where  $xx$  is the asset class for the table entry)
- Create a plan accumulator table with an entry for each destination plan in the current portfolio that has reposition to field equal to within plan. Each entry should contain a Plan # (multiple input plans may go to a single destination plan) and a buy amount. All the buy amounts should be initialized to zero.

- For each input asset, do the following:

Compute work buy amount = (current value of the input asset - hold amount for the input asset)

IF work buy amount > 0

Locate the Plan # in the plan accumulator table <sup>2</sup>

Add work buy amount to buy amount in the corresponding table entry.

END\_IF

<sup>2</sup> IF the asset belongs to a plan which has Reposition To Plan = "new plan", use the Reposition To Plan # to search the Plan Accumulator Table; otherwise, use the Plan #.

- Determine whether the number of equations needed for the model will be too large for LP processing engine.

Determine Asset Class Count, the number of asset classes in the asset hierarchy which are included in rebalancing.

Determine Target Portfolio Asset Class Count, the number of lowest level asset classes in the target portfolio.

Compute Estimated Variables, the estimated the number of variables in the model, as the sum of the following:

4 \* Asset Class Count

Target Portfolio Asset Class Count \* count of plans with buy amount > 0 and non-restricted investment options.

For each plan with restricted investment options, the number of investment options in the plan.

Sum of the number of alternate asset classes defined in all entries of the Alternate Class Array within the Alternate Asset Table \* Number of non-taxable plans with buy amount > 0

Target Portfolio Asset Class Count

#### Required Buy Variables

Compute Estimated Constraints, the estimated number of constraints in the model, as the sum of the following:

Number of plans with buy amount > 0

3 \* Asset Class Count

Target Portfolio Asset Class Count

Required Buy Constraints

# of entries in the Alternate Asset Table

4 if there is one or more annuity plans with a buy amount > 0

1 if there is at least one Roth plan with a buy amount > 0

1 if there is at least one taxable plan with a buy amount > 0

IF Estimated Variables >= Maximum Variables  
or Estimated Constraints >= Maximum Constraints

Set Status to BE and exit from this routine

END\_IF

- Identify which asset classes should be used for purchases to achieve the desired preferred investments in the plan type. Since advice is given only on purchasing Vanguard funds, a list of asset classes to be used will be developed for Roth IRA's, annuities, and taxable accounts.

Total Roth Purchases = 0

Total Annuity Purchases = 0

Total Taxable Purchases = 0

Create a set of work variances from the adjusted target portfolio variances. Each variance included in the work variances should consist of the asset class and associated variance amount. A variance should only be included in the work variances if it is for one of the lowest level asset classes and the variance is negative (i.e. the class is under weighted). The work variance amount should be an unsigned amount.

Locate all plans in the plan accumulator table which have a plan type of Roth, VGI annuity, or are taxable. Add the buy amount from the table entry to the appropriate total purchases accumulator created above.

Using the Roth purchase hierarchy to define the order in which variances are evaluated, go through the list of work variances to determine the asset classes which should be used for purchases in Roth plans. Continue through the hierarchy until Total Roth Purchases amount is equal to zero. Keep track of the classes to be purchased in the Roth plan(s) and the amount to be purchased in the class.

If the asset class in the hierarchy is found in the target portfolio and the work variance amount > 0  
 Search the Alternate Asset Class Table for a match on the asset class in the hierarchy to Tax Exempt Bond Class  
 IF the asset class has a match on Tax Exempt Bond Class  
 Add each of the asset classes in the Alternate Class Array to the list of asset classes to be used for Roth accounts  
 Add work variance amount to Amount Moved To Taxable Class in the matching Alternate Asset Class Table entry  
 ELSE  
 Add the asset class to the list of asset classes to be used for Roth accounts  
 END\_IF  
 IF Total Roth Purchases >= work variance amount  
 Subtract work variance amount from Total Roth Purchases.  
 Move zero to work variance amount.  
 ELSE  
 Subtract Total Roth Purchases from work variance amount.  
 Move zero to Total Roth Purchases.  
 END\_IF  
 ELSE  
 Go on with the next asset class in the purchase hierarchy.  
 END\_IF

Repeat this same process for annuities and taxable accounts using the purchase amounts for those classes and creating a separate list of asset classes for each of the different types. On the taxable accounts, there would be no switch from a tax exempt asset class to a taxable asset class as is described for the Roth plan. This switch to taxable asset classes would occur for the annuity.

- The asset classes for non-zero work variances that remain will be allocated to tax deferred plans (retirement accounts). Replace any tax exempt asset classes with the alternate class. Do the following:

Go through the table of work variances. For each variance entry with a variance amount > 0, search the Alternate Asset Class Table for a match on the asset class for the variance to the Tax Exempt Bond Class.

IF there is a matching entry in the Alternate Asset Class Table  
 Add the work variance amount to the Amount Moved To Taxable Class  
 Move zero to work variance amount  
 Add a new entry to the work variance table for each Asset Class in the Alternate Class Array.  
 The work variance amount for these entries should be set to 1. (*Variance amount does not matter as long as it is greater than zero so that the class will be included for purchases.*)  
 ELSE  
 go on to the next variance entry in the table  
 END\_IF

- Build equations to identify the amount to be purchased in each asset class within a plan and limit these purchases to the amount available to spend within each plan. Assume that a purchase can be done in any of the lowest level asset classes within the target portfolio (not the adjusted target). Do the following for each plan in the plan accumulator table:

IF buy amount for the plan > 0

IF plan investment options are not restricted

Create an equation formatted as  $Bpid\_xx1+Bpid\_xx2+Bpid\_xx...=buy\ amount$  (where *pid* is the plan # and *xx* is a detail asset class. For Roth and taxable accounts, use the list of asset classes previously identified to be used for purchases in that account type. For other account types, use all work variance asset classes for which the corresponding work variance amount is > 0. There should be one entry for each of the asset classes within the list to be used for the plan type or that is a lowest level asset class in the target portfolio.)

ELSE

Create an equation formatted as

$Bpid\_xx1+Bpid\_xx2+Bpid\_xx...+Bpid\_M\_nn1+Bpid\_M\_nn2+Bpid\_M\_nn...=buy\ amount$  (where *pid* is the plan #, *xx* is a detail asset class from the investments available to the plan, and *nn* is a restricted asset #. There should be one entry of the format *Bpid\\_xx* for each of the unique investment alternatives available to the plan which has a 100% allocation to an asset class and is an asset class that is included in rebalancing. If the asset class is not included in rebalancing, go up the asset hierarchy until an ancestor is located that is included in rebalancing; include this ancestor asset class in the formula. If there are two choices in the plan for an asset class, the asset class should be included in the equation only once. There should be one entry of the format *Bpid\\_M\\_nn* for each investment alternative in the plan where the asset class allocation is split between multiple classes. Do not include a multi-class fund in the formula if all the classes which comprise it are represented by single class fund alternatives.)

END\_IF

Write the equation to Model File.

END\_IF

- If a class allocated to the Roth or taxable plans would appear in another type of plan and there is more than one asset class available to the plan, build a formula to require purchasing the amount allocated to the particular plan type. There would be at least one formula for each class that spans multiple plan types. Format the formula as  $Bpid\_xx+Bpid\_xx...+Bpid\_xx=a$  where *Bpid\\_xx* is a plan buy of the asset class for each of the plans of the type in which the amount should be controlled and *a* is the amount which should be purchased in the asset class within that plan type.

Example 1:

Plans 1 and 2 are Roth plans, plan 3 is a taxable plan, and plan 4 is an IRA. Asset classes have been split between the plans as follows:

Roth - SQ \$100, SK \$300

taxable - SK \$100, SW \$400

other - SW - \$100, BC \$500

Formulas to enforce the desired purchases would be:

$B1\_SK + B2\_SK = 300$

$B3\_SK = 100$

$B3\_SW = 400$

Example 2:

Plans 1 and 2 are Roth plans, plan 3 is a taxable plan, and plan 4 is an IRA. Asset classes have been split between the plans as follows:

Roth - SQ \$100,  
taxable - SW \$100  
other - SW \$300, SX \$200

No control formulas would be needed since the Roth and taxable plan types are only buying in a single asset class.

- Annuity plans have restricted asset selections, so it is more difficult to control which classes are purchased in these plans. Formulas are needed to control the type of assets (type of assets) purchased in these plans, with the LP engine controlling the actual asset class selection from those available to the plan based on getting as close as possible to the targets.

Based on the asset classes and amounts which should be purchased in the annuity plan(s), determine the amount to be purchased in each of the SAA categories (stocks, bonds, and cash).

For each of these categories which is greater than zero, determine which asset class choices for the plan are descendants of the SAA. (A balanced fund may have portions in multiple SAA's.) For each of these categories which is greater than zero and for which selections were identified, build a formula formatted as  $Bpid1\_xx1 + Bpid1\_xx2 + \dots Bpid1\_xxn + Bpidn\_xx1 + \dots Bpidn\_xxn + \%Bpid1\_M\_1 + \dots \%Bpid1\_M\_n + \%Bpidn\_M\_1 + \dots Bpidn\_M\_n = Y$  (where  $pid1 \dots n$  represents the plan number for each annuity plan,  $xx1 \dots n$  represents each asset class purchased in an annuity plan which is a descendant of the category, and  $\%Bpidn\_M\_1 \dots n$  represents a balanced asset for which part of the asset adds to the category. A balanced fund would only be included if part of it adds to the category and it was included in the original purchase formula for the plan. The % represents the portion of the asset which belongs in the category.  $Y$  = the total amount to be purchased in the annuity plans for the category.)

- Adjust the adjusted target amounts developed for all asset classes within the hierarchy. Do the following for each entry in the Alternate Asset Class Table which has an Amount Moved To Taxable Class > 0:

Locate the Tax Exempt Bond Class in the table of asset classes and adjusted targets. Subtract Amount Moved To Taxable Class from the adjusted target amount.

IF the Alternate Class Count in the Alternate Asset Class Table entry is 1

Locate the Asset Class for the one entry in the Alternate Class Array within the table of asset classes and adjusted targets.

Add the Amount Moved To Taxable Class to the adjusted target amount

Go on to process the next entry in the Alternate Asset Class Table

ELSE

Desired Total Allocation = Amount Moved To Taxable Class

Set Amount Applied = 0

Set Adjustment Needed = 0

Add the Hold Amount for all asset class entries in the Alternate Asset Array to the Desired Total Allocation

Compute Maintain Percent = sum of the Asset Class Percents for all entries in the Alternate Asset Array

Repeat the following process until Desired Total Allocation = 0

For each Alternate Asset Array entry

Compute Adjustment Amount =  $[(\text{Asset Class Percent} / \text{Maintain Percent}) * \text{Desired Total Allocation}]$ . Round the amount based on m\_RoundingTo.  
 IF Adjustment Amount > (Desired Total Allocation - Amount Applied)  
     Adjustment Amount = (Desired Total Allocation - Amount Applied)  
 END\_IF  
 Add Adjustment Amount to Amount Applied  
 IF Adjustment Amount < Hold Amount for the asset class  
     Compute Adjustment Needed = Adjustment Needed + (Hold Amount - Adjustment Amount)  
     Adjustment Amount = Hold Amount  
 END\_IF  
 Locate Asset Class from the Alternate Asset Array entry in the table of asset classes and adjusted target amounts. Add Adjustment Amount to the adjusted target amount.  
 Subtract Amount Applied from Desired Total Allocation  
 Amount Applied = 0  
 END\_LOOP  
 IF Adjustment Needed > 0  
     Set Amount Applied = 0  
     Repeat the following process until Adjustment Needed = 0  
         For each Alternate Asset Array entry with Hold Amount < Adjusted Target Amount  
             Compute Adjustment Amount =  $[(\text{Asset Class Percent} / \text{Maintain Percent}) * \text{Adjustment Needed}]$ . Round the amount based on m\_RoundingTo.  
             IF Adjustment Amount > (Adjustment Needed - Amount Applied)  
                 Adjustment Amount = (Adjustment Needed - Amount Applied)  
             END\_IF  
             Locate Asset Class from the Alternate Asset Array entry in the table of asset classes and adjusted target amounts.  
             IF (Adjusted Target Amount - Hold Amount) < Adjustment Amount  
                 Adjustment Amount = (Adjusted Target Amount - Hold Amount)  
             END\_IF  
             Subtract Adjustment Amount from Adjusted Target Amount  
             Add Adjustment Amount to Amount Applied  
             Subtract Amount Applied from Adjustment Needed  
             Amount Applied = 0  
         END\_LOOP  
     END\_IF  
     Go on to process the next entry in the Alternate Asset Class Table  
 END\_IF

- Go through the asset hierarchy from top to bottom to build variance equations which limit the current holdings in an asset class, plus any buys in the asset class, to the adjusted target amount. Start at the IV level and do the following:

Identify all asset classes that are direct children of the current asset class.

IF current asset class = IV

    work target amount = total portfolio value

ELSE

    Locate the asset class in the table of asset classes and adjusted target amounts.

    IF the asset class is found



```

        work target amount = adjusted target amount for the asset class
    ELSE
        work target amount = 0
    END_IF
END_IF

```

If the asset class should be included in rebalancing, create an equation to get current holdings,

holdings in child asset classes, and purchases to a single variable for the asset class. The equation should be formatted as

$C_{xx} + H_{yy1} + H_{yy2} + H_{yy} \dots + Bpid1_{xx1} + Bpid2_{xx} + Bpid \dots_{xx} + aBpid1_{M\_nn1} + aBpid1_{M\_nn2} + aBpid \dots_{M\_nn} - H_{xx} = 0$  (Where *xx* is the current asset class and *yy* is each of the asset classes which are direct children to the current asset class. *Pid* is a plan #. *a* is the allocation for the asset class participation in a "balanced fund" and *nn* is a restricted asset #. There should be one purchase of the format *Bpid\_xx* for each plan with a buy amount greater than zero in which the current asset class can be purchased. For Roth, VGI annuities, and taxable accounts, use the list of asset classes to be used for the plan type to determine whether there can be a purchase for the plan. For all other account types, if the the account type does not have restricted funds, the current asset class must be a work variance asset class for which the corresponding work variance amount is > 0. If the account type does have restricted funds, the current asset class must be in the list of available investments as an asset class that is a 100% component of the investment choice or be an ancestor of an investment which is allocated 100% to an asset class which is a descendant of the current asset class and is not included in rebalancing. For such an asset class, the current asset class must be the first ancestor which is included in rebalancing. There should be one or more purchases of the format *aBpid\_M\_nn* for each restricted investment plan with a buy amount > 0 and at least one asset comprised of multiple asset classes which has the current asset class as one of the component classes. There would be a separate entry for each of the multi-class assets in the plan which contains the current asset class. The allocation amount, *a*, would be the allocation within the asset that asset class contributes to the total investment choice-e.g. .1 for 10%. If a class within the allocation is not included in rebalancing, search up through the classes ancestors in the hierarchy until a class that is included in rebalancing is located.)

IF current asset class = IV

Create an equation formatted as  $H_{xx} = \text{work target amount}$  (where *xx* = the current asset class)

Write the equation to Model File

ELSE

Create an equation formatted as  $H_{xx} + V_{xx\_M} - V_{xx\_P} = \text{work target amount}$  (where *xx* = the current asset class)

Write the equation to Model File

END\_IF

- Create an equation to get a single variance amount for all of the detail level variances which must be minimized. This equation should only contain asset classes in which purchases can occur - i.e. asset classes from the target portfolio.

Identify all lowest level asset classes within the target portfolio (not adjusted target).

Create an equation formatted as  $V_{xx1\_M} + V_{xx1\_P} + V_{xx2\_M} + V_{xx2\_P} + V_{xx} \dots_{M} + V_{xx} \dots_{P} - \text{assetvar} = 0$  (Where *xx* is a detail asset class. There should be one set of minus and plus variances

*for each of the lowest level asset classes within the target portfolio or which is an alternate to a non-taxable asset class within the target portfolio which was used for a purchase in a plan.)*

Write the equation to Model File.

- Create an equation to get a single variance amount for all of the SAA variances which must be minimized. Do the following:

Locate all direct children of the IV asset class.

Create an equation formatted as  $V_{xx1\_M} + V_{xx1\_P} + V_{xx2\_M} + V_{xx2\_P} + V_{xx...\_M} + V_{xx...\_P} - SAAvar = 0$  (Where *xx* is an asset class that is a child of IV. There should be one set of minus and plus variances for each of the SAA asset classes within the target portfolio.)

Write the equation to Model File.

- Create an equation to get a single variance amount for all of the intermediate variances which must be minimized. This set of variances is for the level directly below the SAA's. Do the following:

For each of the asset classes identified as SAA's in the target portfolio in the previous equation, locate the asset classes which are direct children of these classes.

Determine which of these children asset classes is in the target portfolio. That is, at least one of the lowest level asset classes summarizes to the asset class. If the asset class itself is a detail entry (e.g. the level below cash are detail entries), the asset class would not be selected for inclusion in the equation.

Create an equation formatted as  $V_{xx1\_M} + V_{xx1\_P} + V_{xx2\_M} + V_{xx2\_P} + V_{xx...\_M} + V_{xx...\_P} - intervar = 0$  (Where *xx* is an asset class that is a child of an SAA and is in the target portfolio as a summary class, not a lowest level entry. There should be one set of minus and plus variances for each of the selected asset classes.)

Write the equation to Model File.

- Create an equation for the US stock variance amounts which must be minimized. Do the following:

Identify all asset classes in the asset hierarchy which are direct children of asset class SA.

Determine which of these children asset classes is in the target portfolio. That is, at least one of the lowest level asset classes summarizes to the asset class. If the asset class itself is a detail entry (e.g. the level below cash are detail entries), the asset class would not be selected for inclusion in the equation.

Create an equation formatted as  $V_{xx1\_M} + V_{xx1\_P} + V_{xx2\_M} + V_{xx2\_P} + V_{xx...\_M} + V_{xx...\_P} - USstkvar = 0$  (Where *xx* is an asset class that is a child of an SAA and is in the target portfolio as a summary class, not a lowest level entry. There should be one set of minus and plus variances for each of the selected asset classes.)

Write the equation to Model File.

- Remove entries from the additional purchases asset table if there is no money to spend in the plan. Go through each asset in the additional purchases asset table and do the following:

Locate the plan # in the plan accumulator table.

IF the buy amount = 0

Delete the asset from the additional purchases asset table

END\_IF

- Remove entries from the additional purchases table if the asset class should not be used for the plan. For each entry in the additional purchase asset table, do the following:

IF the plan is a Roth or VGI annuity  
or the account type is taxable

IF the asset class is not in the list of asset types to be used for the plan  
Delete the entry from the table

END\_IF

ELSE

IF the asset class in the table entry is not in the list of work variance asset classes with a  
corresponding work variance amount greater than zero

Delete the entry from the table

END\_IF

END\_IF

- Create equations to encourage purchases in registrations which already contain preferred or alternate funds in asset classes for which purchases may be done.

Sort the additional purchase asset table by plan # within asset class.

For each unique asset class in the table, do the following:

Create an equation to encourage purchases in the plan which has an account in the asset class.

Format the equation as  $Bpid1\_xx + Bpid2\_xx + Bpid...\_xx - bad\_xx = 0$  (where pid is the plan # for each plan in the plan accumulator table which has a buy amount > 0, a purchase for the asset class can be done in the plan, and there is no entry in the additional purchase asset table for the asset class being processed. xx is the asset class being processed. A plan can purchase in an asset class if the plan is a Roth, VGI annuity, or taxable account and the asset class is included in the list of asset classes to be used for the plan. For other plan types (non-taxable accounts), any asset class in the additional purchase asset table could be purchased.)

Write the equation to Model File

Create an equation to summarize the "bad" purchase choices to a single variable. Format the equation as  $bad\_xx1 + bad\_xx2 + bad\_xx... - addpurch = 0$  (Where xx1 is an asset class. There should be one entry for each unique asset class in the additional purchase asset table.)

Write the equation to Model File

- Write the following statement to Model File:

END

- Close Model File
- Return to caller with successful completion status.

### **Determine Funds To Buy**

For each plan that has a buy amount > 0, go through the output from LP processing engine and locate all the associated buy variables for that plan (Bpid\_xx - where pid is the plan # and xx is an asset class to be purchased or Bpid\_M\_nn-where pid is the plan # and nn represents a specific asset available to the plan.) Do the following:

Adjust the non-zero buy variables for the plan.

Round all non-zero buy variables for the plan, except the last, up or down based on m\_RoundingTo.

For the last non-zero buy variable for the plan, set the variable = (buy amount for the plan - the sum of all the rounded buy variables for the plan).

Perform Build Asset Class Buy Control Table

Go through each entry in the Asset Class Buy Control Table and do the following:

Perform Update Control Table With Fund Info

Perform Total Buy Amounts For The Asset Class

Go through all of the adjusted buy variables. Select variables with a name format of Bpid\_xx (where pid is the plan # and xx is the asset class), the asset class matches asset class for the Asset Class Buy Control Table entry being processed, and the adjusted variable amount > 0. For each selected variable, do the following:

IF (m\_PortfolioTilt = TE (tax efficient) and plan # is for a tax deferred plan

Perform Tax Efficient Tax Deferred Preferred Fund Additional Purchase

ELSE

Perform General Preferred Fund Additional Purchase

END\_IF

Go through all of the adjusted buy variables. Select variables with a name format of Bpid\_xx (where pid is the plan # and xx is the asset class), the asset class matches asset class for the Asset Class Buy Control Table entry being processed, and the adjusted variable amount > 0. For each selected variable, do the following:

IF (m\_PortfolioTilt = TE (tax efficient) and plan # is for a tax deferred plan

Perform Tax Efficient Tax Deferred Alternate Fund Additional Purchase

ELSE

Perform General Alternate Fund Additional Purchase

END\_IF

Go through all of the adjusted buy variables. Select variables with a name format of *Bpid\_xx* (where *pid* is the plan # and *xx* is the asset class), the asset class matches asset class for the Asset Class Buy Control Table entry being processed, and the adjusted variable amount > 0. For each selected variable, do the following:

IF (m\_PortfolioTilt = TE (tax efficient) and plan # is for a tax deferred plan  
Perform Tax Efficient Tax Deferred Asset Class Buys

ELSE

Perform General Asset Class Buys

END\_IF

Go through all adjusted buy variables. For each specific fund variable (name format is *Bpid\_M\_nn*) where adjusted variable amount > 0, do the following:

Set preferred fund number to use to the fund number value for asset nn in the restricted fund list for the plan

IF the fund number for asset nn is NULL (fund is not a Vanguard fund)

set preferred fund title to use to the title value for asset nn in the restricted fund list for the plan

ELSE

Locate preferred fund number to use in the Vanguard Fund List

IF the fund is found

set preferred fund title to use to the title for the matching entry in the Vanguard Fund List

ELSE

set preferred fund title to use to nulls

END\_IF

END\_IF

Go through the output Investments to determine if the preferred fund already exists in the plan. If fund number is not null, use that as the match criteria; otherwise, use fund title.

IF the preferred fund to use is already owned by the plan

Add the buy amount from adjusted buy variable to the Buy Amount for the output asset

Add the buy amount from adjusted buy variable to the Proposed Amount for the output asset

Move zero to the buy amount for the adjusted buy variable

ELSE

Plan # = pid from the buy variable name

Work asset class breakdown = asset class breakdown for asset nn (from the buy variable name) in the restricted fund list for plan # = pid from the buy variable name

Work buy amount = adjusted variable amount

Perform Add Fund To Output Assets

Adjusted variable amount = 0

END\_IF

### **Build Asset Class Buy Control Table**

Go through all adjusted buy variables and develop a list of unique asset classes for which a purchase is to be done. For each asset class in the list, do the following:

Initialize the table entry fields:

Asset Class = current asset class from the list of buys

All amounts and counts for the entry = 0

All flags for the entry = NO

Add the formatted entry to the Asset Class Buy Control Table

#### Update Control Table With Fund Info

Zero all occurrences of the Buy Amount Work Fields

*Locate taxable funds for the asset class*

IF m\_PortfolioTilt = TE (tax efficient)

use Fund List For Tax Efficient Portfolio

ELSE

use Primary Fund List

END\_IF

Search the fund list determined above to locate all entries with asset class = Asset Class and preferred/alternate flag = P

For each entry found, update the appropriate taxable split fields as follows:

IF Split Fund # for the returned entry = 0

Set indx = 1

ELSE

Set indx = Split Fund # for the returned entry

END\_IF

Taxable Fund # (indx) = VGI Fund Number for the returned entry

Taxable Split Rate (indx) = Split Rate for the returned entry

IF number of entries returned > 0

Set Taxable Preferred Fund Found Flag to YES

Set Taxable Preferred Fund Count = number of entries returned

IF number of entries returned > 1

Set Split Taxable Buy Flag to YES

END\_IF

END\_IF

*Locate tax exempt funds for the asset class. This is not done for all asset classes, only when taxable and tax exempt fund choices are different.*

IF m\_PortfolioTilt = TE (tax efficient)

Search the Primary Fund List to locate all entries with asset class = Asset Class and preferred/alternate flag = P

For each entry found, update the appropriate taxable split fields as follows:

IF Split Fund # for the returned entry = 0

Set indx = 1

ELSE

Set indx = Split Fund # for the returned entry

END\_IF

Tax Exempt Fund # (indx) = VGI Fund Number for the returned entry

Tax Exempt Split Rate (indx) = Split Rate for the returned entry

IF number of entries returned > 0

Set Tax Exempt Preferred Fund Found Flag to YES

Set Tax Exempt Preferred Fund Count = number of entries returned

IF number of entries returned > 1

Set Split Tax Exempt Buy Flag to YES

END\_IF

END\_IF

END\_IF

#### **Total Buy Amounts For The Asset Class**

Go through all adjusted buy variables with names formatted as Bpid\_xx (where pid is the plan # and xx is the asset class). For each variable in which the asset class = Asset Class on the Asset Class Buy Control Table entry being processed, accumulate the adjusted buy amounts. (Amounts are only split between taxable and tax deferred if the investment choices are different. Otherwise, amounts are accumulated in the taxable field.)

Locate the output Investment Plan entry for the plan # (pid).

IF m\_PortfolioTilt = TE (tax efficient)

IF the plan is a taxable plan

Add the adjusted buy amount to Taxable Buy Amount for the Asset Class Buy Control Table Entry

ELSE

Add the adjusted buy amount to Tax Deferred Buy Amount for the Asset Class Buy Control Table Entry

END\_IF

ELSE

Add the adjusted buy amount to Taxable Buy Amount for the Asset Class Buy Control Table Entry

END\_IF

IF Taxable Preferred Fund Found Flag = yes

IF Split Taxable Buy Flag for the Asset Class Buy Control Table entry = no

Taxable Split Amount (1) = Taxable Buy Amount for the table entry  
 ELSE  
 Perform Determine Taxable Split Amounts For The Asset Class  
 END\_IF  
 ELSE  
 Taxable Split Amount (1) = Taxable Buy Amount for the table entry  
 Taxable Split Rate = 1.00  
 END\_IF  
  
 IF m\_PortfolioTilt = TE (tax efficient)  
     *(when taxable and tax deferred buys can be different, determine split amounts based on tax status for the plan)*  
 IF Tax Deferred Preferred Fund Flag = Yes  
     IF Split Tax Deferred Buy Flag for the Asset Class Buy Control Table entry = NO  
         Tax Deferred Split Amount (1) = Tax Deferred Buy Amount for the table entry  
     ELSE  
         Perform Determine Tax Deferred Split Amounts For The Asset Class  
     END\_IF  
 ELSE  
     Tax Deferred Split Amount (1) = Tax Deferred Buy Amount for the table entry  
     Tax Deferred Split Rate (1) = 1.00  
 END\_IF  
 END\_IF

### **Determine Taxable Split Amounts For The Asset Class**

For each non-zero Taxable Fund # in the Buy Amount Work Fields (indx = 1 to indx = 9), do the following:  
 Go through all output Investment Assets  
     IF VGI Fund # for the Investment Asset matches the Taxable Fund # (indx)  
         Add Hold Amount for the Investment Asset to Taxable Fund Holdings (indx)  
     END\_IF  
 Get Total Taxable Amount = [Taxable Buy Amount from the Asset Class Buy Control Table + sum of Taxable Fund Holdings (indx=1 to indx=9)]  
 Adjustment Needed = 0  
 Applied Amount = 0  
 Processed Count = 0  
 Go through all taxable Buy Amount Work Fields (indx = 1 to indx = 9). For each entry, do the following:  
     IF Processed Count < (Taxable Preferred Fund Count - 1)  
         Taxable Split Amount (indx) = [Total Taxable Amount \* Taxable Split Rate(indx)]. Round the result based on m\_RoundingTo.  
         Add Taxable Split Amount (indx) to Applied Amount  
         IF Taxable Split Amount (indx) < Taxable Fund Holdings (indx)  
             Adjustment Needed = {Adjustment Needed + [Taxable Fund Holdings (indx) - Taxable Split Amount (indx)]}  
         END\_IF  
     END\_IF



```

        Taxable Split Amount (indx) = [Taxable Fund Holdings (indx) - Taxable Split Amount
        (indx)]
    END_IF
ELSE
    Taxable Split Amount (indx) = [Total Taxable Amount - Applied Amount]
    IF Taxable Split Amount (indx) < Taxable Fund Holdings (indx)
        Adjustment Needed = {Adjustment Needed + [Taxable Fund Holdings (indx) - Taxable Split
        Amount (indx)]}
        Taxable Split Amount (indx) = [Taxable Fund Holdings (indx) - Taxable Split Amount
        (indx)]
    END_IF
END_IF

```

```

IF Adjustment Needed > 0
    Total Adjustable Rate = 0

```

```

Go through all taxable Buy Amount Work Fields (indx =1 to indx = 9)
IF Taxable Split Amount (indx) > Taxable Fund Holdings (indx)
    Add Taxable Split Rate (indx) to Total Adjustable Rate
END_IF

```

```

Repeat until Adjustment Needed = 0
    Applied Amount = 0
    Go through all taxable Buy Amount Work Fields (indx = 1 to indx = 9). For each occurrence, do
    the following:

```

```

        IF Taxable Split Amount (indx) > Taxable Fund Holdings (indx)
            Compute Adjustment = [{Taxable Split Rate (indx) / Total Adjustable Rate} *
            Adjustment Needed. Round Adjustment based on m_RoundingTo.
            IF Adjustment > (Adjustment Needed - Applied Amount)
                Adjustment = (Adjustment Needed - Applied Amount)
            END_IF
            IF Adjustment > [Taxable Split Amount (indx) - Taxable Fund Holdings (indx)]
                Adjustment = [Taxable Split Amount (indx) - Taxable Fund Holdings (indx)]
            END_IF
            Taxable Split Amount (indx) = [Taxable Split Amount (indx) - Adjustment]
            Add Adjustment to Applied Amount
        END_IF

```

```

END_LOOP through Buy Amount Work Fields Adjustment Needed = [Adjustment Needed -
Applied Amount]

```

```

IF Applied Amount = 0

```

```

    Repeat until Adjustment Needed = 0
        Locate the largest Taxable Split Amount
        IF Taxable Split Amount (indx) >= Adjustment Needed
            Subtract Adjustment Needed from Taxable Split Amount (indx)
            Adjustment Needed = 0
        ELSE
            Adjustment Needed = Adjustment Needed - Taxable Split Amount (indx)
            Taxable Split Amount (indx) = 0
        END_IF

```

```

        END_REPEAT
    END_IF
END_REPEAT
END_IF

```

### Determine Tax Deferred Split Amounts For The Asset Class

```

For each non-zero Tax Deferred Fund # in the Buy Amount Work Fields (indx = 1 to indx = 9), do the
following:
    Go through all output Investment Assets
        IF VGI Fund # for the Investment Asset matches the Tax Deferred Fund # (indx)
            Add Hold Amount for the Investment Asset to Tax Deferred Fund Holdings (indx)
        END_IF
Get Total Tax Deferred Amount = [Tax Deferred Buy Amount from the Asset Class Buy Control Table +
sum of Tax Deferred Fund Holdings (indx=1 to indx=9)]
Adjustment Needed = 0
Applied Amount = 0
Processed Count = 0
Go through all tax deferred Buy Amount Work Fields (indx = 1 to indx = 9). For each entry, do the
following:
    IF Processed Count < (Tax Deferred Preferred Fund Count - 1)
        Tax Deferred Split Amount (indx) = [Total Tax Deferred Amount * Tax Deferred Split
        Rate(indx)]. Round the result based on m_RoundingTo.
        Add Tax Deferred Split Amount (indx) to Applied Amount
        IF Tax Deferred Split Amount (indx) < Tax Deferred Fund Holdings (indx)
            Adjustment Needed = {Adjustment Needed + [Tax Deferred Fund Holdings (indx) - Tax
            Deferred Split Amount (indx)]}
            Tax Deferred Split Amount (indx) = [Tax Deferred Fund Holdings (indx) - Tax Deferred
            Split Amount (indx)]
        END_IF
    ELSE
        Tax Deferred Split Amount (indx) = [Total Tax Deferred Amount - Applied Amount]
        IF Tax Deferred Split Amount (indx) < Tax Deferred Fund Holdings (indx)
            Adjustment Needed = {Adjustment Needed + [Tax Deferred Fund Holdings (indx) - Tax
            Deferred Split Amount (indx)]}
            Tax Deferred Split Amount (indx) = [Tax Deferred Fund Holdings (indx) - Tax Deferred
            Split Amount (indx)]
        END_IF
    END_IF
IF Adjustment Needed > 0
    Total Adjustable Rate = 0

    Go through all tax deferred Buy Amount Work Fields (indx =1 to indx = 9)
    IF Tax Deferred Split Amount (indx) > Tax Deferred Fund Holdings (indx)
        Add Tax Deferred Split Rate (indx) to Total Adjustable Rate
    END_IF

Repeat until Adjustment Needed = 0

```

Applied Amount = 0

Go through all tax deferred Buy Amount Work Fields (indx = 1 to indx = 9). For each occurrence, do the following:

```
IF Tax Deferred Split Amount (indx) > Tax Deferred Fund Holdings (indx)
  Compute Adjustment = [{Tax Deferred Split Rate (indx) / Total Adjustable Rate} *
    Adjustment Needed. Round Adjustment based on m_RoundingTo.
  IF Adjustment > (Adjustment Needed - Applied Amount)
    Adjustment = (Adjustment Needed - Applied Amount)
  END_IF
  IF Adjustment > [Tax Deferred Split Amount (indx) - Tax Deferred Fund Holdings
    (indx)]
    Adjustment = [Tax Deferred Split Amount (indx) - Tax Deferred Fund Holdings
    (indx)]
  END_IF
  Tax Deferred Split Amount (indx) = [Tax Deferred Split Amount (indx) - Adjustment]
  Add Adjustment to Applied Amount
END_IF
END_LOOP through Buy Amount Work Fields Adjustment Needed = [Adjustment Needed -
  Applied Amount]
IF Applied Amount = 0
  Repeat until Adjustment Needed = 0
    Locate the largest Tax Deferred Split Amount
    IF Tax Deferred Split Amount (indx) >= Adjustment Needed
      Subtract Adjustment Needed from Tax Deferred Split Amount (indx)
      Adjustment Needed = 0
    ELSE
      Subtract Tax Deferred Split Amount (indx) from Adjustment Needed
      Tax Deferred Split Amount (indx) = 0
    END_IF
  END_REPEAT
END_IF
Applied Amount = 0
END_REPEAT
END_IF
```

#### **General Preferred Fund Additional Purchase**

*(This routine is used for any taxable asset class buys and tax deferred asset class buys for all portfolios except the tax efficient.)*

IF Taxable Preferred Fund Found Flag = yes

*(Try to buy an existing preferred fund)*

Go through each of the taxable split occurrences (indx=1 to indx=9). For each occurrence, do the following:

IF Taxable Split Amount (indx) > 0

Search the output Investment Assets for a match with Plan # in the Investment Asset matches  
pid from the variable name and VGI Fund # for the Investment Asset matches Taxable  
Fund # (indx)

When a match is found

IF Taxable Split Amount (indx)  $\geq$  adjusted variable amount

Add adjusted variable amount to Buy Amount for the selected Investment Asset

Add adjusted variable amount to Proposed Amount for the selected Investment Asset

Subtract adjusted variable amount from Taxable Split Amount (indx)

Move zero to adjusted variable amount

Processing of this buy variable is complete. Exit from this routine.

ELSE

Add Taxable Split Amount (indx) to Buy Amount for the selected Investment Asset

Add Taxable Split Amount (indx) to Proposed Amount for the selected Investment Asset

Subtract Taxable Split Amount (indx) from the adjusted variable amount

Move Zero to the Taxable Split Amount (indx)

Go on to next split amount

END\_IF

END\_IF

END\_IF

#### **General Alternate Fund Additional Purchase**

*(This routine is used for any taxable asset class buys and tax deferred asset class buys for all portfolios except the tax efficient.)*

*(Try to buy in existing alternate funds.)*

IF Taxable Preferred Fund Found Flag = yes

Go through each of the taxable split variables (indx=1 to indx=9). For each occurrence, do the following :

IF Taxable Split Amount (indx) > 0

*(Try to buy in an existing alternate fund for one of the breakdowns for the asset class.)*

IF m\_PortfolioTilt = TE (tax efficient)

use the Fund List For Tax Efficient Portfolio as the source of alternate funds

ELSE

use the Primary Fund List as the source for alternate funds

END\_IF

Locate all entries on either the Primary Fund List or Fund List For Tax Efficient Portfolio (depending on result of check done above) with Asset Class = Asset Class for the current Asset Class Buy Control Table entry, Preferred/Alternate Flag = A, and Split Fund # = indx. For each selected entry, do the following:

Search the output Investment Assets for an entry with Plan # = pid from the variable name and VGI Fund # = VGI fund number from the selected alternate asset

When a match is found

IF Taxable Split Amount (indx)  $\geq$  adjusted variable amount

Add adjusted variable amount to Buy Amount for the selected Investment Asset

Add adjusted variable amount to Proposed Amount for the selected Investment Asset

Subtract adjusted variable amount from Taxable Split Amount (indx)

Move zero to adjusted variable amount

Processing of this buy variable is complete. Exit from this routine.

ELSE  
 Add Taxable Split Amount (indx) to Buy Amount for the selected Investment Asset  
 Add Taxable Split Amount (indx) to Proposed Amount for the selected Investment Asset  
 Subtract Taxable Split Amount (indx) from the adjusted variable amount  
 Move Zero to the Taxable Split Amount (indx)  
 Go on to next split amount  
 END\_IF

END\_IF

END\_IF

*(All money for the buy variable was not used. Try to buy an existing alternate fund that covers the entire asset class.)*

Locate all entries on either the Primary Fund List or Fund List For Tax Efficient Portfolio (depending on the check done above) with Asset Class = Asset Class for the current Asset Class Buy Control Table entry, Preferred/Alternate Flag = A, and Split Fund # = 0. For each selected entry, do the following:

Search the output Investment Assets for an entry with Plan # = pid from the variable name and VGI Fund # = VGI fund number from the selected alternate asset

When a match is found

Add adjusted variable amount to Buy Amount for the selected Investment Asset

Perform Apply Purchase To All Non-Zero Taxable Split Amounts

Processing of this buy variable is complete. Exit from this routine.

END\_IF

#### General Asset Class Buys

*(This routine is used for any taxable asset class buys and tax deferred asset class buys for all portfolios except the tax efficient.)*

*(Buy variable amount was not entirely spent on purchases of existing primary or alternate funds. Create new preferred fund investments.)*

IF Taxable Preferred Fund Found

Search all occurrences of taxable split amounts (indx=1 to indx=9). For each occurrence, do the following:

IF Taxable Split Amount > 0 and (plan is not restricted or Taxable Fund # is in the list of investments available to the plan)

Preferred fund number to use = Taxable Fund # (indx)

IF Taxable Split Amount (indx) >= adjusted buy variable amount

Work buy amount = adjusted buy variable amount

ELSE

Work buy amount = Taxable Split Amount (indx)

END\_IF

Plan # = pid from adjusted buy variable name

Perform Buy A Preferred Fund Subtract Work buy amount from Taxable Split Amount (indx)

Subtract Work buy amount from adjusted buy variable

IF adjusted buy variable = 0

Processing for buy variable is complete. Exit from this routine.  
 ELSE  
 Go on to process the next taxable split occurrence  
 END\_IF  
 END\_IF  
 END\_IF

*(All of the buy amount was not used in a purchase of a preferred fund. If the plan is a restricted plan, try to buy an alternate fund.)*

IF Taxable Preferred Fund Found and plan is restricted.

*(Buy in specific alternate funds if they are available to the plan)*

Search all occurrences of taxable split amounts (indx=1 to indx=9). For each occurrence, do the following:

IF Taxable Split Amount > 0

Locate all alternate funds on the Primary Fund List for the asset class. Look for entries with Asset Class = Asset Class, Preferred/Alternate Flag = A, Split Fund # = indx. For each located alternate fund, do the following:

IF the VGI fund number for the selected alternate is in the list of restricted assets

Preferred fund number to use = VGI Fund Number for the selected alternate

IF Taxable Split Amount (indx) >= adjusted buy variable amount

Work buy amount = adjusted buy variable amount

ELSE

Work buy amount = Tax Deferred Split Amount (indx)

END\_IF

Work plan # = pid from adjusted buy variable

Perform Buy A Preferred Fund

Subtract Work buy amount from Taxable Split Amount (indx)

Subtract Work buy amount from adjusted buy variable

IF adjusted buy variable = 0

Processing for buy variable is complete. Exit from this routine.

ELSE

Go on to process the next tax deferred split occurrence

END\_IF

END\_IF

END\_IF

*(Buy in a non specific VGI alternate fund if one is available to the plan)*

Locate all alternate funds on the Primary Fund List for the asset class. Look for entries with Asset Class = Asset Class, Preferred/Alternate Flag = A, Split Fund # = 0. For each located alternate fund, do the following:

IF the VGI fund number for the selected alternate is in the list of restricted assets

Preferred fund number to use = VGI fund number from the selected alternate

Work buy amount = adjusted buy variable amount

Work Plan # = pid of adjusted variable name

Perform Buy A Preferred Fund

Perform Apply Purchase To All Non-Zero Taxable Split Amounts

Processing of this buy variable is complete. Exit from this routine.

END\_IF

*(Buy in the first VGI fund for the class that is available to the plan. This is a non-specific buy.)*  
Go through all restricted assets available to the plan to locate an entry with VGI fund number not equal to nulls, (asset class (1) = Asset Class or is a child of Asset class), and asset class % (1) = 1.00.

IF an asset is selected

Preferred fund number to use = VGI fund number from the selected restricted asset

Work buy amount = adjusted buy variable amount

Work Plan # = pid from adjusted buy variable name

Perform Buy A Preferred Fund

Perform Apply Purchase To All Non-Zero Taxable Split Amounts

Processing of this buy variable is complete. Exit from this routine.

END\_IF

*(Buy in the first non-VGI fund for the class that is available to the plan. This is a non-specific buy.)*

Go through all restricted assets available to the plan to locate an entry with VGI fund number equal to nulls, asset class (1) = Asset Class or is a child of Asset Class, and asset class % (1) = 1.00.

IF an asset is selected

Preferred fund number to use = nulls

Preferred fund title to use = Title for selected restricted asset

Work buy amount = adjusted buy variable amount

Work Plan # = pid from adjusted buy variable name

Work asset class breakdown = Asset Class Breakdown for the restricted asset

Perform Add Fund To Output Assets

Perform Apply Purchase To All Non-Zero Taxable Split Amounts

Processing of this buy variable is complete. Exit from this routine.

END\_IF

END\_IF

*(If this section is reached, the buy amount could not be used in any of the preferred or alternate funds. This should not happen.)*

IF plan is taxable

Preferred fund number to use = m\_TaxAcctDCAFund

ELSE

Preferred fund number to use = m\_TaxExmptDCAFund

END\_IF

Plan id = pid from adjusted buy variable name

Work buy amount = adjusted variable amount

Perform Buy A Preferred Fund

IF Produce Explanations = yes

Record explanation "Purchase of nnnn for asset class xx in plan zzzz was made to the money market because no preferred fund was identified for the asset class." (where nnnn is the adjusted variable amount, xx is the class from the variable name, and zzzz is the plan name for the output Investment Plan with Plan # equal to pid from the variable name.)

END\_IF  
Subtract Work buy amount from Taxable Split Amount (1)  
Subtract Work buy amount from adjusted buy variable  
Processing for buy variable is complete. Exit from this routine.

#### **Tax Efficient Tax Deferred Preferred Fund Additional Purchase**

IF Tax Deferred Preferred Fund Found Flag = yes  
*(Try to buy an existing preferred fund)*  
Go through each of the tax deferred split occurrences (indx=1 to indx=9). For each occurrence, do the following:

IF Tax Deferred Split Amount (indx) > 0

Search the output Investment Assets for a match with Plan # in the Investment Asset matches  
pid from the variable name and VGI Fund # for the Investment Asset matches Tax  
Deferred Fund # (indx)

When a match is found

IF Tax Deferred Split Amount (indx) >= adjusted variable amount

Add adjusted variable amount to Buy Amount for the selected Investment Asset  
Add adjusted variable amount to Proposed Amount for the selected Investment Asset  
Subtract adjusted variable amount from Tax Deferred Split Amount (indx)  
Move zero to adjusted variable amount  
Processing of this buy variable is complete. Exit from this routine.

ELSE

Add Tax Deferred Split Amount (indx) to Buy Amount for the selected Investment  
Asset  
Add Tax Deferred Split Amount (indx) to Proposed Amount for the selected  
Investment Asset  
Subtract Tax Deferred Split Amount (indx) from the adjusted variable amount  
Move Zero to the Tax Deferred Split Amount (indx)  
Go on to next split amount

END\_IF

END\_IF

END\_IF

#### **Tax Efficient Tax Deferred Alternate Fund Additional Purchase**

IF Tax Deferred Preferred Fund Found Flag = yes  
*(Try to buy in existing alternate funds.)*

Go through each of the tax deferred split variables (indx=1 to indx=9). For each occurrence, do the following :

IF Tax Deferred Split Amount (indx) > 0

Locate all entries on the Primary Fund List with Asset Class = Asset Class for the current  
Asset Class Buy Control Table entry, Preferred/Alternate Flag = A, and Split Fund # =  
indx. For each selected entry, do the following:



Search the output Investment Assets for an entry with Plan # = pid from the variable name and VGI Fund # = VGI fund number from the selected alternate asset

When a match is found

IF Tax Deferred Split Amount (indx) >= adjusted variable amount

Add adjusted variable amount to Buy Amount for the selected Investment Asset

Add adjusted variable amount to Proposed Amount for the selected Investment Asset

Subtract adjusted variable amount from Tax Deferred Split Amount (indx)

Move zero to adjusted variable amount

Processing of this buy variable is complete. Exit from this routine.

ELSE

Add Tax Deferred Split Amount (indx) to Buy Amount for the selected Investment Asset

Add Tax Deferred Split Amount (indx) to Proposed Amount for the selected Investment Asset

Subtract Tax Deferred Split Amount (indx) from the adjusted variable amount

Move Zero to the Tax Deferred Split Amount (indx)

Go on to next split amount

END\_IF

END\_IF

END\_IF

*(Buy variable was not completely spent on purchases of alternates for specific fund splits. Try to buy in an existing alternate that covers the entire asset class.)*

Locate all entries on the Primary Fund List with Asset Class = Asset Class for the current Asset Class Buy Control Table entry, Preferred/Alternate Flag = A, and Split Fund # = 0. For each selected entry, do the following:

Search the output Investment Assets for an entry with Plan # = pid from the variable name and VGI Fund # = VGI fund number from the selected alternate asset

When a match is found

Add adjusted variable amount to Buy Amount for the selected Investment Asset

Add adjusted variable amount to Proposed Amount for the selected Investment Asset

Perform Apply Purchase To All Non-Zero Tax Deferred Split Amounts

Processing of this buy variable is complete. Exit from this routine.

### **Tax Efficient Tax Deferred Asset Class Buys**

*(Buy variable amount was not entirely spent on purchases of existing primary or alternate funds. Create new preferred fund investments.)*

IF Tax Deferred Preferred Fund Found

Search all occurrences of tax deferred split amounts (indx=1 to indx=9). For each occurrence, do the following:

IF Tax Deferred Split Amount > 0 and (plan is not restricted or Tax Deferred Fund # (indx) is in the list of funds available to the plan)

Preferred fund number to use = Tax Deferred Fund # (indx)

IF Tax Deferred Split Amount (indx) >= adjusted buy variable amount

Work buy amount = adjusted buy variable amount

ELSE

Work buy amount = Tax Deferred Split Amount (indx)

END\_IF

Work Plan # = pid from adjusted variable name

Perform Buy A Preferred Fund

Subtract Work buy amount from Tax Deferred Split Amount (indx)

Subtract Work buy amount from adjusted buy variable

IF adjusted buy variable = 0

Processing for buy variable is complete. Exit from this routine.

ELSE

Go on to process the next tax deferred split occurrence

END\_IF

END\_IF

END\_IF

*(All of the buy amount was not used up in the purchase of existing or a new preferred fund. Should only be here for restricted plans.)*

IF Tax Deferred Preferred Fund Found Flag = Yes and plan is restricted

*(Buy in specific alternate funds if they are available to the plan)*

Search all occurrences of tax deferred split amounts (indx=1 to indx=9). For each occurrence, do the following:

IF Tax Deferred Split Amount > 0

Locate all alternate funds on the Primary Fund List for the asset class. Look for entries with Asset Class = Asset Class, Preferred/Alternate Flag = A, Split Fund # = indx. For each located alternate fund, do the following:

IF the VGI fund number for the selected alternate is in the list of restricted assets

Preferred fund number to use = VGI Fund Number for the selected alternate )

IF Tax Deferred Split Amount (indx) >= adjusted buy variable amount

Work buy amount = adjusted buy variable amount

ELSE

Work buy amount = Tax Deferred Split Amount (indx)

END\_IF

Work plan # = pid from adjusted buy variable

Perform Buy A Preferred FundSubtract Work buy amount from Tax Deferred Split Amount (indx)

Subtract Work buy amount from adjusted buy variable

IF adjusted buy variable = 0

Processing for buy variable is complete. Exit from this routine.

ELSE

Go on to process the next tax deferred split occurrence

END\_IF

END\_IF  
END\_IF  
END\_IF

IF plan is restricted(*Buy in a non specific VGI alternate fund if one is available to the plan*)  
Locate all alternate funds on the Primary Fund List for the asset class. Look for entries with Asset  
Class = Asset Class, Preferred/Alternate Flag = A, Split Fund # = 0. For each located alternate  
fund, do the following:

IF the VGI fund number for the selected alternate is in the list of restricted assets  
Preferred fund number to use = VGI fund number from the selected alternate  
Work buy amount = adjusted buy variable amount  
Work Plan # = pid of adjusted variable name

Perform Buy A Preferred FundPerform Apply Purchase To All Non-Zero Tax Deferred Split  
Amounts

Processing of this buy variable is complete. Exit from this routine.

END\_IF

(*Buy in the first VGI fund for the class that is available to the plan. This is a non-specific buy.*)  
Go through all restricted assets available to the plan to locate an entry with VGI fund number not equal  
to nulls, asset class (1) = Asset Class or is a child of Asset Class, and asset class % (1) = 1.00.

IF an asset is selected

Preferred fund number to use = VGI fund number from the selected restricted asset  
Work buy amount = adjusted buy variable amount  
Work Plan # = pid from adjusted buy variable name  
Perform Buy A Preferred Fund  
Perform Apply Purchase To All Non-Zero Tax Deferred Split Amounts  
Processing of this buy variable is complete. Exit from this routine.

END\_IF

(*Buy in the first non-VGI fund for the class that is available to the plan. This is a non-specific buy.*)  
Go through all restricted assets available to the plan to locate an entry with VGI fund number not equal  
to nulls, asset class (1) = Asset Class or is a child of the asset class, and asset class % (1) = 1.00.

IF an asset is selected

Preferred fund number to use = nulls  
Preferred fund title to use = Title for selected restricted asset  
Work buy amount = adjusted buy variable amount  
Work Plan # = pid from adjusted buy variable name  
Work asset class breakdown = asset class breakdown for the selected restricted asset  
Perform Add Fund To Output Assets  
Perform Apply Purchase To All Non-Zero Tax Deferred Split Amounts  
Processing of this buy variable is complete. Exit from this routine.

END\_IF

END\_IF

(*should not happen since asset class would not have been a buy if there was no selection*)  
Preferred fund number to use = m\_TaxExmptDCAFund

Work buy amount = adjusted variable amount  
 Work Plan # = pid from adjusted buy variable name  
 Perform Buy A Preferred Fund  
 IF Produce Explanations = yes  
     Record explanation "Purchase of *nnnn* for asset class *xx* in plan *zzzzz* was made to the money market because no preferred fund was identified for the asset class." (*where nnnn is the adjusted variable amount, xx is the class from the variable name, and zzzz is the plan name for the output Investment Plan with Plan # equal to pid from the variable name.*)  
 END\_IF  
 Perform Apply Purchase To All Non-Zero Tax Deferred Split Amounts  
 Subtract Work buy amount from adjusted buy variable  
 Processing for buy variable is complete. Exit from this routine.

### **Buy A Preferred Fund**

Locate Preferred Fund Number To Use in Vanguard Fund List  
 IF fund is found  
     Preferred Fund Title To Use = fund title from the matching Vanguard Fund List entry  
     Work Asset Class Breakdown = asset class breakdown from the matching Vanguard Fund List entry  
 ELSE  
     Preferred Fund Title To Use = Nulls  
     Work asset class breakdown = spaces  
     Asset Class (1) of Work asset class breakdown = Asset Class being processed  
     Asset Class percent (1) of Work asset class breakdown = 1.00  
 END\_IF  
 Perform Add Fund To Output Assets

### **Apply Purchase to All Non-Zero Tax Deferred Split Amounts**

Repeat the following until adjusted variable amount = 0  
     Applied amount = 0  
     Compute total rates = sum of all Tax Deferred Split Rates for any entry where Tax Deferred Split Amount > 0  
     Go through each tax deferred split occurrence (indx=1 to indx=9). For each occurrence, do the following:  
         Compute adjustment = [(Tax Deferred Split Rate (indx) / total rates) \* adjusted variable amount.  
         Round adjustment based on m\_RoundingTo.  
         IF adjustment > (adjusted variable amount - applied amount)  
             adjustment = (adjusted variable amount - applied amount)  
         END\_IF  
         IF adjustment > Tax Deferred Split Amount (indx)  
             adjustment = Tax Deferred Split Amount (indx)  
         END\_IF  
         Subtract adjustment from Tax Deferred Split Amount (indx)  
         Add adjustment to applied amount

END\_LOOP through Tax Deferred Split occurrences  
 Subtract applied amount from adjusted variable amount  
 IF Applied Amount = 0  
     Repeat until Adjusted Variable Amount = 0  
         Locate the largest Tax Deferred Split Amount  
         IF Tax Deferred Split Amount (indx) >= Adjusted Variable Amount  
             Subtract Adjusted Variable Amount from Tax Deferred Split Amount (indx)  
             Adjusted Variable Amount = 0  
         ELSE  
             Subtract Tax Deferred Split Amount (indx) from Adjusted Variable Amount  
             Tax Deferred Split Amount (indx) = 0  
         END\_IF  
     END\_REPEAT  
 END\_IF  
 Applied amount = 0  
 END\_REPEAT

#### Apply Purchase to All Non-Zero Taxable Split Amounts

Repeat the following until adjusted variable amount = 0  
     Applied amount = 0  
     Compute total rates = sum of all Taxable Split Rates for any entry where Taxable Split Amount > 0  
     Go through each taxable split occurrence (indx=1 to indx=9). For each occurrence, do the following:  
         Compute adjustment = [(Taxable Split Rate (indx) / total rates) \* adjusted variable amount.  
         Round adjustment based on m\_RoundingTo.  
         IF adjustment > (adjusted variable amount - applied amount)  
             adjustment = (adjusted variable amount - applied amount)  
         END\_IF  
         IF adjustment > Taxable Split Amount (indx)  
             adjustment = Taxable Split Amount (indx)  
         END\_IF  
         Subtract adjustment from Taxable Split Amount (indx)  
         Add adjustment to applied amount  
 END\_LOOP through Taxable Split occurrences Subtract applied amount from adjusted variable amount  
 IF Applied Amount = 0  
     Repeat until Adjusted Variable Amount = 0  
         Locate the largest Taxable Split Amount  
         IF Taxable Split Amount (indx) >= Adjusted Variable Amount  
             Subtract Adjusted Variable Amount from Taxable Split Amount (indx)  
             Adjusted Variable Amount = 0  
         ELSE  
             Subtract Taxable Split Amount (indx) from Adjusted Variable Amount  
             Taxable Split Amount (indx) = 0  
         END\_IF  
     END\_REPEAT

END\_IF  
Applied amount = 0  
END\_REPEAT

### **Buy Cleanup**

Review all Output Investment Assets, doing the following:

IF Buy Amount > 0 and < Minimum Txn Amount

Add up all Buy Amounts for the plan

IF the total Buy Amounts for the plan < Minimum Txn Amount (*this should not happen unless the very small accounts have been marked as definitely repositionable*)

Go on to next Output Investment Asset

END\_IF

Perform Develop Reallocation List

For each entry in the Reallocation List, Perform Reallocate Low Buy

IF Buy Amount for selected asset = 0 and Current Amount for selected asset = 0

Delete selected asset from the list of Output Investments

END\_IF

END\_IF

Review all Output Investment Assets, doing the following:

IF VGI Fund Flag indicates the fund is a Vanguard fund

and Proposed Amount > 0

and Buy Amount = Proposed Amount

and Proposed Amount < Fund Minimum Amount based on the type of plan (*tax exempt plans use retirement minimum, all others use retail minimum*)

IF the selected asset is the only buy for the plan

Go on to next Output Investment Asset

END\_IF

Perform Develop Reallocation List

For each entry in the Reallocation List, Perform Reallocate Asset Class Buy

IF Buy Amount for selected asset = 0 and Current Amount for selected asset = 0

Delete selected asset from the list of Output Investments

END\_IF

END\_IF

### **Develop Reallocation List**

Tot Amt To Reallocate = Buy amount for the selected asset

Amt Split = 0

Go through each used asset class (i.e. not nulls or spaces) in the asset class breakdown for the selected asset and create the Reallocation List. This list is a list of asset classes and associated portion of the selected buy amount which must be reallocated to another asset(s). For each asset class in the breakdown, do the following:

```
Compute Amt = (Tot Amt To Reallocate * Percent from the asset class breakdown entry being
processed) rounded based on m_RoundingTo.
IF Amt > (Tot Amt To Reallocate - Amt Split)
    Amt = (Tot Amt To Reallocate - Amt Split)
END_IF
Add Amt to Amt Split
IF Amt > 0
    Add an entry to the Reallocation List containing the asset class from the breakdown entry being
    processed and amount = Amt
END_IF
```

```
IF Amt Split = 0 (should only happen if all calculated amounts end up rounding down to 0)
    Add an entry to the Reallocation List containing asset class (1) from the asset class breakdown and
    amount = Tot Amt To Reallocate
END_IF
```

#### Add Fund To Output Assets

Add 1 to Last Used Asset #

Add a new Investment Asset to the output. Asset # = Last Used Asset #, Plan # = Work asset class, asset class breakdown = work asset class breakdown, VGI Fund # = preferred fund number to use, VGI Fund Flag = "Vanguard fund", Title = preferred fund title to use, Current Amount = 0, Buy Amount = work buy amount, Sell Amount = 0, Proposed Amount = work buy amount, Tax Cost = 0, Fee Amount = 0

#### Reallocate Asset Class Buy

Adjustment Needed = Amount from Reallocation List Entry  
Current Asset Class = Asset Class from Reallocation List Entry

*(Look for an alternate purchase asset in the same asset class)*

Search all assets associated with the plan to which the selected asset being reallocated belongs for any asset other than the selected asset which has asset class (1) = Current Asset Class and asset class percent (1) = 1.00 and Buy Amount > 0.

IF an alternate asset is found

```
Add Adjustment Needed to Buy Amount for the alternate asset
Add Adjustment Needed to Proposed Amount for the alternate asset
IF Produce Explanations = Yes
```

Record an explanation of "Buy amount of  $x$  in fund  $y$  for plan  $m$  was reallocated to  $z$  because the purchase is below the fund minimum." where  $x$  = Adjustment Needed,  $Y$  = title of the selected asset,  $m$  = plan name of the selected asset, and  $z$  = title of the alternate asset.

END\_IF  
 Subtract Adjustment Needed from Buy Amount for the selected asset  
 Subtract Adjustment Needed from Proposed Amount for the selected asset  
 Processing for this Reallocation List Entry is complete  
 END\_IF

*(Look for alternate purchase assets in similar asset classes)*  
 Repeat this process until Current Asset Class = IV *(will only happen if other purchases were to be balanced funds)* or Adjustment Amount = 0 *(current Reallocation List Entry amount has been reallocated)*

Review the asset hierarchy to identify the parent asset class for the Current Asset Class

Review all assets within the plan other than the selected asset being reallocated

IF there are investments which are preferred or alternate fund selections in the plan which would sum to the parent asset class<sup>3</sup> and have asset class percent (1) = 1.00

Create a list of the Investment Assets which meet this criteria (referred to later as Selected Alternative Assets). For each asset, include the Asset #, the first asset class *(assumes that all preferred and alternate funds are single asset class allocations)*, and a percent which is initialized to zero.

Perform Reallocate Buy

ELSE

Set Current Asset Class = parent asset class

END\_IF

IF Adjustment Needed = 0

IF Produce Explanations = yes

Record an Explanation of "Buy amount of  $x$  in fund  $y$  for plan  $m$  was reallocated to  $z$  because the proposed amount is below the fund minimum." where  $x$  is the Amount from the Reallocation List Entry,  $y$  is the name of the fund for the selected asset,  $m$  is the plan name for the plan, and  $z$  is a list of the fund names for the assets in the Selected Alternative Assets list.

END\_IF

Subtract Amount from Reallocation List Entry from Buy Amount for the selected asset

Subtract Amount from Reallocation List Entry from Proposed Amount for the selected asset

Processing for this Reallocation List Entry is complete

END\_IF

<sup>3</sup> IF selected asset is not in a restricted plan, IF  $m\_PortfolioTilt$  is "tax efficient" and the plan is a taxable plan, use the Fund List For Tax Efficient Portfolio to determine the preferred and alternate funds; otherwise, use the Primary Fund List. IF the selected asset is in a restricted plan, any asset in the list of funds available to the plan is considered a preferred fund.

*(No single asset class asset could be located to which the purchase can be reallocated. Try to locate a balanced fund which contains the asset class.)*

Current Asset Class = Asset Class from Reallocation List Entry

Repeat this process until Current Asset Class = IV *(should not happen)* or Adjustment Amount = 0 *(current Reallocation List Entry amount has been reallocated)*

Review all assets within the plan other than the selected asset being reallocated



IF there are investments which (contain an asset class = current asset class or an asset class that would sum to current asset class) and are preferred or alternate fund selections in the plan (as defined for the last search)

Select the first asset found which meets the criteria as the alternate asset

Add Adjustment Needed to Buy Amount for the alternate asset

Add Adjustment Needed to Proposed Amount for the alternate asset

IF Produce Explanations = Yes

Record an explanation of "Buy amount of  $x$  in fund  $y$  for plan  $m$  was reallocated to  $z$  because the purchase is below the fund minimum." where  $x$  = Adjustment Needed,  $Y$  = title of the selected asset,  $m$  = plan name of the selected asset, and  $z$  = title of the alternate asset.

END\_IF

Subtract Adjustment Needed from Buy Amount for the selected asset

Subtract Adjustment Needed from Proposed Amount for the selected asset

Processing for this Reallocation List Entry is complete

ELSE

Set Current Asset Class = parent asset class

END\_IF

#### **Reallocate Low Buy**

Set Adjustment Needed = Amount for the Reallocation List entry

Set Current Asset Class = Asset Class of the Reallocation List entry

(Try to find another buy for a single asset class buy in either the same asset class or a similar asset class)

Repeat the following process until Current Asset Class = IV (will only happen if all other buys are to balanced funds) or Adjustment Amount = 0 (current buy has been reallocated)

Search the Output Investment Assets for another buy in the same plan as the selected asset with (asset class (1) = current asset class or in a class which sums to current asset class), Asset Class Percent (1) = 1.00, and Buy Amount > 0.

IF an alternate investment is found

Add Adjustment Needed to Buy Amount and Proposed Amount for the alternate asset

IF Produce Explanations = yes

Record an Explanation of "Buy amount of  $x$  in fund  $y$  for plan  $m$  was reallocated to  $z$  because the amount was less than the minimum transaction amount." where  $x$  is Adjustment Needed,  $y$  is the name of the fund for the selected asset,  $m$  is the plan name for the plan, and  $z$  is the name of the fund for the alternate Investment Asset.

END\_IF

Subtract Adjustment Needed from Buy Amount for the selected asset

Subtract Adjustment Needed from Proposed Amount for the selected asset

Move zero to Adjustment Needed

Processing for this Reallocation List entry is complete

END\_IF

Review the asset hierarchy to identify the parent asset class for the Current Asset Class

Set Current Asset Class = parent asset class

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Determine Investments.doc

Auto Rebalancing Project

12/21/98

Linear Programming Version Of Auto Rebal Object

Auto Rebal Object - Determine How To Invest Proceeds From Asset Sales Page - 401

*(Could not find a single asset class purchase for the same or related asset class. Look for a balanced fund purchase that contains the asset class or a related asset class.)*

Set Current Asset Class = Asset Class of the Reallocation List entry

Repeat the following process until Current Asset Class = IV *(should not happen)* or Adjustment Amount = 0 *(current buy has been reallocated)*

Search the Output Investment Assets for another buy in the same plan as the selected asset with (any asset class in the asset class breakdown = current asset class or in a class which sums to current asset class) and Buy Amount > 0.

IF an alternate investment is found

Add Adjustment Needed to Buy Amount and Proposed Amount for the alternate asset

IF Produce Explanations = yes

Record an Explanation of "Buy amount of  $x$  in fund  $y$  for plan  $m$  was reallocated to  $z$  because the amount was less than the minimum transaction amount." where  $x$  is Adjustment Needed,  $y$  is the name of the fund for the selected asset,  $m$  is the plan name for the plan, and  $z$  is the name of the fund for the alternate Investment Asset.

END\_IF

Subtract Adjustment Needed from Buy Amount for the selected asset

Subtract Adjustment Needed from Proposed Amount for the selected asset

Processing for this Reallocation List entry is complete

END\_IF

Review the asset hierarchy to identify the parent asset class for the Current Asset Class

Set Current Asset Class = parent asset class

### Reallocate Buy

Review the Selected Alternative Assets

IF there are multiple assets for a single asset class

IF the plan is not restricted and one of the assets is for a preferred fund<sup>4</sup>

Delete all the other assets for this asset class from the Selected Alternative Assets

ELSE

Delete all assets for the asset class except the one with the highest proposed amount

END\_IF

END\_IF

<sup>4</sup> If  $m\_PortfolioTilt$  is "tax efficient" and the plan to which the asset being replaced belongs is taxable, use the Fund List For Tax Efficient Portfolio to determine preferred and alternate funds. Otherwise, use the Primary Fund List.

Assign a target percent for each of the Selected Alternative Assets. Go through each of the Selected Alternative Assets and do the following:

IF the asset class of the Selected Alternative Asset is in the target portfolio  
Set percent for the current Selected Alternative Asset = target portfolio percent for the asset class

ELSE

Set percent for the current Selected Alternative Asset = 0

END\_IF

When all of the Selected Alternative Assets have been reviewed, sum the assigned percents.

IF the sum of the assigned percents = 0

Count the number of Selected Alternative Assets

Set percent for each of the Selected Alternative Assets = 1/Count

ELSE

Delete any Selected Alternative Assets for which percent = 0

END\_IF

Get Target Sum = sum of percents for the Selected Alternative Assets

Repeat this process until Adjustment Needed = 0

Adjustment Applied = 0

Go through each of the Selected Alternative Assets and do the following:

Compute Adjustment Amount = [(percent for the current Selected Alternative Asset / Target Sum)  
\* Adjustment Needed] Round Adjustment Amount based on m\_Rounding\_To.

IF Adjustment Amount > (Adjustment Needed - Adjustment Applied)

Adjustment Amount = (Adjustment Needed - Adjustment Applied)

END\_IF

Using the Asset # to located the Output Investment Asset, update the entry with the adjustment by  
adding Adjustment Amount to the Buy Amount for the asset.

Adjustment Applied = (Adjustment Applied + Adjustment Amount)

IF (Adjustment Needed - Adjustment Applied) = 0

Terminate loop through Selected Alternative Assets

END\_IF

End\_Loop through Selected Alternative Assets

Adjustment Needed = (Adjustment Needed - Adjustment Applied)

IF Adjustment Applied = 0

Locate the Selected Alternative Asset with the highest percent. If there are multiple entries with  
the same percent, select the first one.

Add Adjustment Needed to the Buy Amount for the asset

Adjustment Needed = 0

ELSE Adjustment Applied = 0

END\_IF

END\_LOOP for processing Adjustment Needed.

### **Buy Fund Adjustments**

Perform International Fund Replacement

Perform Bond Index Fund Replacement

IF m\_PortfolioTilt = NO (Core) or TE (Tax Efficient)

    Perform Total Stock Market Replacement

END\_IF

### **International Fund Replacement**

IF S4 is in the target portfolio

    and S5 is in the target portfolio

        Compute new S4 amount = sum of all buys to asset class S4 where S4 is the only asset class for the investment and the investment is a new investment (current amount = 0) and the plan to which the asset belongs is either unrestricted or offers fund 113 as an option.

        Compute new S5 amount = sum of all buys to asset class S5 where S5 is the only asset class for the investment and the investment is a new investment and the plan to which the asset belongs is either unrestricted or offers fund 113 as an option.

        Compute current S4 amount = sum of all current amounts for asset class S4

        Compute current S5 amount = sum of all current amounts for asset class S5

        IF current S4 amount = 0 and current S5 amount = 0 and (new S4 amount > 0 or new S5 amount > 0)

            Perform Total International Portfolio Substitution

            Processing for this routine is complete

        END\_IF

        IF new S4 amount = 0 or new S5 amount = 0

            Switch to the substitute fund can not be done. Exit from this routine.

        END\_IF

        IF (new S4 amount / new S5 amount) >= [(S4 percent in target portfolio/ S5 percent in target portfolio) \* (1 - m\_TotalIntlPortfolioToleranceMinus)]

            and (new S4 amount / new S5 amount) <= [(S4 percent in target portfolio/ S5 percent in target portfolio) \* (1 + m\_TotalIntlPortfolioPlus)]

            Perform Total International Portfolio Substitution

            Processing for this routine is complete

END\_IFEND\_IF

### **Total International Portfolio Substitution**

Set preferred fund number to use to 113

Locate 113 in the list of Vanguard Funds

IF 113 is found

    Set preferred fund title to use to the fund title found in the list of Vanguard Funds

    Set Work asset class breakdown to asset class breakdown for the matching entry in the Vanguard Fund list

ELSE

    Set preferred fund title to use to nulls

    Set Work asset class breakdown to spaces

    Asset class (1) of Work asset class breakdown = S4

    Asset class percent (1) of Work asset class breakdown = S4 percent in target portfolio

Asset class (2) of Work asset class breakdown = S5  
Asset class percent (2) of Work asset class breakdown = S5 percent in target portfolio  
END\_IF

Go through all output Investment Assets and select assets with buy amount > 0, current amount = 0, (first asset class in asset class breakdown = S4 or S5) and first asset class percent in asset class breakdown = 1.00), and VGI fund number not equal to 113. For each selected asset, do the following:

IF plan is not restricted or 113 is in the list of restricted funds for the plan  
Try to locate an asset entry for the fund 113 in the current plan  
IF an existing entry for fund 113 was found in the plan  
Add the buy amount for the selected asset to the buy amount for the existing fund 113 investment  
Add the buy amount for the selected asset to the proposed amount for the existing fund 113 investment  
Delete the selected asset from the output Investment Assets  
ELSE  
Set work buy amount to buy amount for the selected asset  
Work Plan # = plan # from the selected Investment Asset Perform Add Fund To Output Assets  
Perform Add Fund To Output Assets  
Delete the selected asset from the output Investment Assets  
END\_IF

END\_IF

#### **Bond Index Fund Replacement**

IF short term corp. bonds are in the target portfolio  
and short term treasuries are in the target portfolio  
Asset Class A = BC (short term corp)  
Asset Class B = BT (short term treasuries)  
Substitute Fund # = 132 (Short-term Bond Index)  
Perform General Fund Replacement  
END\_IF

IF intermediate term corp. bonds are in the target portfolio  
and intermediate term treasuries are in the target portfolio  
Asset Class A = BO (intermediate term corp)  
Asset Class B = BU (intermediate term treasuries)  
Substitute Fund # = 314 (Intermediate-term Bond Index)  
Perform General Fund Replacement  
END\_IF

IF long term corp. bonds are in the target portfolio  
and long term treasuries are in the target portfolio  
Asset Class A = BK (long term corp)  
Asset Class B = BY (long term treasuries)  
Substitute Fund # = 522 (Long-term Bond Index)  
Perform General Fund Replacement  
END\_IF

### General Fund Replacement

Locate the asset class breakdown data for the Substitute Fund #.

Set Percent A to the percent from the asset class breakdown for the Substitute Fund # for asset class A.

Set Percent B to the percent from the asset class breakdown for the Substitute Fund # for asset class A.

*(If there is no percent available for either of the classes, fund replacement can not be done. Exit from this routine.)*

Compute new A amount = sum of all buys to asset class A where A is the only asset class for the investment and the investment is a new investment (current amount = 0) and the plan to which the asset belongs is either unrestricted or offers substitute fund # as an option.

Compute new B amount = sum of all buys to asset class B where B is the only asset class for the investment and the investment is a new investment and the plan to which the asset belongs is either unrestricted or offers substitute fund # as an option.

Compute current A amount = sum of all current amounts for asset class A

Compute current B amount = sum of all current amounts for asset class B

IF current A amount = 0 and current B amount = 0 and (new A amount > 0 or new B amount > 0)

    A amount = new A amount

    B amount = new B amount

    Perform General Fund Substitution

    Processing for this routine is complete

END\_IF

IF new A amount = 0 or new B amount = 0

    Switch to the substitute fund can not be done. Exit from this routine.

END\_IF

IF current A amount > 0 and current B amount > 0

    Replacement can not be done. Exit from procedure.

END\_IF

IF percent A <= percent B

    A amount = new A amount

    Total index amount = (A amount / A percent) rounded based on m\_RoundingTo

    B amount = (Total index amount - A amount)

    IF B amount >= new B amount

        B amount = new B amount

        Total index amount = (B amount / B percent) rounded based on m\_RoundingTo

        A amount = (Total index amount - B amount)

        IF A amount >= new A amount

            A amount = new A amount

    ELSE

        IF (new A amount - A amount) <= general retail fund minimum

            A amount = new A amount

        END\_IF

    END\_IF

ELSE

IF (new B amount - B amount) <= general retail fund minimum  
     B amount = new B amount  
 END\_IF  
 END\_IFELSE  
     B amount = new B amount  
     Total index amount = (B amount / B percent) rounded based on m\_RoundingTo  
     A amount = (Total index amount - B amount)  
     IF A amount >= new A amount  
         A amount = new A amount  
         Total index amount = (A amount / A percent) rounded based on m\_RoundingTo  
         B amount = (Total index amount - A amount)  
         IF B amount >= new B amount  
             B amount = new B amount  
         ELSE  
             IF (new B amount - B amount) <= general retail fund minimum  
                 B amount = new B amount  
             END\_IF  
         END\_IF  
     ELSE  
         IF (new A amount - A amount) <= general retail fund minimum  
             A amount = new A amount  
         END\_IF  
     END\_IF  
 END\_IF  
 IF A amount > 0 and B amount > 0  
     IF {[ (new A amount - A amount) = 0 and current A amount = 0]  
         or [ (new B amount - B amount) = 0 and current B amount = 0] }  
         Perform General Fund Substitution  
         Processing for this routine is complete  
     END\_IF  
 END\_IF

### **General Fund Substitution**

Set preferred fund number to use to substitute fund #  
 Locate the substitute fund # in the list of Vanguard Funds  
 IF the substitute fund # is found  
     Set preferred fund title to use to the fund title found in the list of Vanguard Funds  
     Set Work asset class breakdown to asset class breakdown for the matching entry in the Vanguard Fund list  
 ELSE  
     Set preferred fund title to use to nulls  
     Set Work asset class breakdown to spaces  
     Asset class (1) of Work asset class breakdown = Asset Class A  
     Asset class percent (1) of Work asset class breakdown = A Percent  
     Asset class (2) of Work asset class breakdown = Asset Class B  
     Asset class percent (2) of Work asset class breakdown = B Percent

END\_IF

Go through all output Investment Assets and select assets with buy amount > 0 (first asset class in asset class breakdown = Asset Class A or Asset Class B) and first asset class percent in asset class breakdown = 1.00), and VGI fund number not equal to substitute fund #. Process assets which have current amount = 0 first. For each selected asset, do the following:

IF plan is not restricted or substitute fund # is in the list of restricted funds for the plan

IF the selected asset is for asset class A

IF A amount = 0

Work buy amount = 0

ELSE

IF buy amount for the selected asset <= A amount

or (buy amount for the selected asset - A amount) <= fund minimum (check either the retail or retirement minimum depending on the plan type)

Work buy amount = buy amount for the selected asset

ELSE

Work buy amount = A amount

END\_IF

IF Work Buy Amount <= A Amount

Subtract Work buy amount from A amount

ELSE

A amount = 0

END\_IF

END\_IF

ELSE

IF B amount = 0

Work buy amount = 0

ELSE

IF buy amount for the selected asset <= B amount

or (buy amount for the selected asset - B amount) <= fund minimum (check either the retail or retirement minimum depending on the plan type)

Work buy amount = buy amount for the selected asset

ELSE

Work buy amount = B amount

END\_IF

IF Work Buy Amount <= B Amount

Subtract Work buy amount from B amount

ELSE

B amount = 0

END\_IF

END\_IF

END\_IF

IF Work buy amount > 0

Try to locate an asset entry for the substitute fund # in the current plan

IF an existing entry for the substitute fund # was found in the plan

Add the Work buy amount to the buy amount for the existing substitute fund # investment



Add the Work buy amount to the proposed amount for the existing substitute fund  
# investment

ELSE

Work Plan # = plan # from the selected Investment Asset Perform Add Fund To Output  
Assets

Perform Add Fund To Output Assets

END\_IF

Subtract Work buy amount from the buy amount for the selected asset

Subtract Work buy amount from the proposed amount for the selected asset

IF proposed amount for the selected asset = 0

Delete the selected asset from the Output Assets

END\_IF

END\_IF

END\_IF

### **Total Stock Market Replacement**

Compute new SQ amount = sum of all buys to asset class SQ where SQ is the only asset class for the investment and the purchase is a new buy (current amount = 0) and the plan to which the asset belongs is either unrestricted or offers fund 85 or 102 as an option.

Compute new SX amount = sum of all buys to asset class SX where SX is the only asset class for the investment or all asset classes in the investment are descendants of SX and the purchase is a new buy (current amount = 0) and the plan to which the asset belongs is either unrestricted or offers fund 85 or 102 as an option.

IF new SQ amount = 0 or new SX amount = 0

No switch can be done. Exit from this routine.

END\_IF

IF m\_PortfolioTilt = TE (tax efficient)

Compute TMSP amount = sum of all proposed amounts in fund 85 (TSMP) in taxable plans

Compute Cap Appreciation Amount = sum of all proposed amounts in fund (102) in taxable plans

Compute new SQ amount = (new SQ amount + TSMP amount + Cap Appreciation Amount)

END\_IF

IF (new SQ amount / new SX amount) > [(target SQ allocation rate / target SX allocation rate) \* (1 - m\_TSMPortfolioToleranceMinus)]

and (new SQ amount / new SX amount) < [(target SQ allocation rate / target SX allocation rate) \* (1 + m\_TSMPortfolioTolerancePlus)]

Perform Switch To Total Stock Market Portfolio

Processing for this routine is complete

END\_IF

### **Switch To Total Stock Market Portfolio**

*General TSMP Switch*

Set preferred fund number to use to 85 (TSMP-Total Stock Market Portfolio)

Locate preferred fund number to use in the list of Vanguard Funds

IF preferred fund number to use is found

Set preferred fund title to use to the fund title found in the list of Vanguard Funds

Set Work asset class breakdown to the asset class breakdown for the entry in the list of Vanguard Funds

ELSE

Set preferred fund title to use to nulls

Set Work asset class breakdown to spaces

Set asset class (1) of Work asset class breakdown to S6

Set asset class percent (1) to 1.00

END\_IF

Go through all output Investment Assets. Select an asset if buy amount > 0, [(first asset class in asset class breakdown = SQ or SX) and first asset class percent in asset class breakdown = 1.00} or all asset classes in the investment are descendants of SX], and VGI Fund # not equal to 85 or 102). For each selected asset, do the following:

IF plan is unrestricted or fund 85 is in the list of restricted investments for the plan

Try to locate an asset entry for fund 85 in the current plan

IF existing TSMP was found in the plan

Add the buy amount for the selected asset to the buy amount for the existing TSMP investment

Add the buy amount for the selected asset to the proposed amount for the existing TSMP investment

Subtract Buy Amount for the selected asset from Proposed Amount for the selected asset

IF Current Amount for the selected asset = 0 and Proposed Amount for the selected asset = 0

Delete the selected asset from the output Investment Assets

END\_IF

Go on to processing the next output Investment Asset

END\_IF

END\_IF

IF plan is unrestricted or fund 102 is in the list of restricted funds for the plan

Try to locate an asset entry for fund 102 in the current plan

IF existing Tax Managed Cap Appreciation was found in the plan

Add the buy amount for the selected asset to the buy amount for the existing investment

Add the buy amount for the selected asset to the proposed amount for the existing investment

Subtract Buy Amount for the selected asset from Proposed Amount for the selected asset

IF Current Amount for the selected asset = 0 and Proposed Amount for the selected asset = 0

Delete the selected asset from the output Investment Assets

END\_IF

Go on to processing the next output Investment Asset

END\_IF

END\_IF

IF plan is unrestricted or fund 85 is in the list of restricted funds for the plan

Set work buy amount to buy amount for the selected asset  
 Perform Add Fund To Output Assets  
 Subtract Buy Amount for the selected asset from Proposed Amount for the selected asset  
 IF Current Amount for the selected asset = 0 and Proposed Amount for the selected asset = 0  
     Delete the selected asset from the output Investment Assets  
 END\_IF  
 END\_IF  
  
 IF fund 102 is in the list of restricted funds for the plan  
     Set preferred fund number to use to 102 (Tax Managed Cap Appreciation)  
     Locate preferred fund number to use in the list of Vanguard Funds  
  
     IF preferred fund number to use is found  
         Set preferred fund title to use to the fund title found in the list of Vanguard Funds  
         Set Work asset class breakdown to the asset class breakdown for the entry in the list of Vanguard Funds  
     ELSE  
         Set preferred fund title to use to nulls  
         Set Work asset class breakdown to spaces  
         Asset class (1) of Work asset class breakdown to SQ  
         Asset class percent (1) of Work asset class breakdown = (SQ target allocation / [SX target allocation + SQ target allocation])  
         Asset class (2) of Work asset class breakdown = SX  
         Asset class percent (2) of Work asset class breakdown = (SX target allocation / [SX target allocation + SQ target allocation])  
     END\_IF  
 Set work buy amount to buy amount for the selected asset  
 Perform Add Fund To Output Assets  
 Subtract Buy Amount for the selected asset from Proposed Amount for the selected asset  
 IF Current Amount for the selected asset = 0 and Proposed Amount for the selected asset = 0  
     Delete the selected asset from the output Investment Assets  
 END\_IF  
 END\_IF

What is claimed is:

## CLAIMS

1. A computerized process for automating investment planning for a client comprising:

- (a) inputting into a computer data regarding the client's current asset portfolio;
- (b) inputting into a computer data regarding the client's desired asset allocation;
- (c) inputting into a computer data regarding the client's preferred domain;
- (d) using the data in steps (a)-(c) to automatically generate financial transaction

recommendations for modifying the client's current asset portfolio to reach as close as possible to the desired asset allocation and the preferred domain, the recommendations including specific recommendations for selling amounts of selected current assets and specific recommendations for buying amounts of one or more investment funds; and

(e) displaying the recommendations on a summary report for review by the client or the client's financial manager.

2. A process according to claim 1 wherein step (d) includes determining tax impacts of potential sell transactions, the recommendations being selected to minimize the tax impacts.

3. A process according to claim 2 wherein the summary report includes the tax impacts of at least some of the recommendations.

4. A process according to claim 2 further comprising:

(f) inputting into a computer data regarding the client's asset portfolio preferences, including current assets that the client wishes to hold or sell, and constraints on asset selling, wherein step (d) further includes using the data in step (f) to automatically generate the financial transaction recommendations.

5. A process according to claim 1 wherein step (d) includes determining transaction costs of potential sell transactions, the recommendations being selected to minimize the transaction costs.

6. A process according to claim 5 wherein the summary report includes the transaction costs of at least some of the recommendations.

7. A process according to claim 1 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and step (d) includes a recommendation to hold the client's possibly repositionable assets if the client's new asset allocation will be within a predetermined percentage of the desired asset allocation after selling all of the client's repositionable assets.

8. A process according to claim 7 wherein the predetermined percentage is about 3%.

9. A process according to claim 1 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and step (d) includes treating the possibly repositionable assets as non-repositionable assets when making the current asset portfolio modifications.

10. A process according to claim 1 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and step (d) includes a recommendation to sell the client's repositionable assets until the tax cost of selling equals a predetermined percentage of the client's current asset portfolio.

11. A process according to claim 1 wherein the recommendations include recommendations to (i) add specific amounts of shares to currently held mutual funds, and (ii) open one or more new mutual funds and contribute specific amounts of shares to the new funds.

12. A process according to claim 1 wherein the desired asset allocation is determined based upon the client's Ibbotson score.

13. A process according to claim 1 wherein step (d) includes developing target portfolio amounts and adjusted target portfolio amounts for each asset category in the desired asset allocation.

14. A method according to claim 1 further comprising:

(f) inputting information regarding the client which is necessary to determine the client's desired asset allocation and the client's preferred domain; and

(g) automatically determining the client's desired asset allocation and the client's preferred domain and using the results as the data inputs in steps (b) and (c).

15. A computerized process for automating and executing investment planning for a client comprising:

(a) inputting into a computer data regarding the client's current asset portfolio;

(b) inputting into a computer data regarding the client's desired asset allocation;

(c) inputting into a computer data regarding the client's preferred domain;

(d) using the data in steps (a)-(c) to automatically generate financial transaction recommendations for modifying the client's current asset portfolio to reach as close as possible to the desired asset allocation and the preferred domain, the recommendations including specific recommendations for selling amounts of selected current assets and specific recommendations for buying amounts of one or more investment funds; and

(e) selling amounts of selected current assets or buying amounts of one or more investment funds in accordance with the specific recommendations.

16. A process according to claim 15 wherein step (d) includes determining tax impacts of potential sell transactions, the recommendations being selected to minimize the tax impacts.

17. A process according to claim 16 wherein the summary report includes the tax impacts of at least some of the recommendations.

18. A process according to claim 16 further comprising:

(f) inputting into a computer data regarding the client's asset portfolio preferences, including current assets that the client wishes to hold or sell, and constraints on asset selling, wherein step (d) further includes using the data in step (f) to automatically generate the financial transaction recommendations.

19. A process according to claim 15 wherein step (d) includes determining transaction costs of potential sell transactions, the recommendations being selected to minimize the transaction costs.

20. A process according to claim 19 wherein the summary report includes the transaction costs of at least some of the recommendations.

21. A process according to claim 15 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and step (d) includes a recommendation to hold the client's possibly repositionable assets if the client's new asset allocation will be within a predetermined percentage of the desired asset allocation after selling all of the client's repositionable assets.

22. A process according to claim 21 wherein the predetermined percentage is about 3%.

23. A process according to claim 15 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and step (d) includes treating the possibly repositionable assets as non-repositionable assets when making the current asset portfolio modifications.

24. A process according to claim 15 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and step (d)

includes a recommendation to sell the client's repositionable assets until the tax cost of selling equals a predetermined percentage of the client's current asset portfolio.

25. A process according to claim 15 wherein the recommendations include recommendations to (i) add specific amounts of shares to currently held mutual funds, and (ii) open one or more new mutual funds and contribute specific amounts of shares to the new funds.

26. A process according to claim 15 wherein the desired asset allocation is determined based upon the client's Ibbotson score.

27. A process according to claim 15 wherein step (d) includes developing target portfolio amounts and adjusted target portfolio amounts for each asset category in the desired asset allocation.

28. A method according to claim 15 further comprising:

(f) inputting information regarding the client which is necessary to determine the client's desired asset allocation and the client's preferred domain; and

(g) automatically determining the client's desired asset allocation and the client's preferred domain and using the results as the data inputs in steps (b) and (c).

29. A method according to claim 15 wherein step (e) further comprises communicating the specific recommendations for selling amounts of selected current assets and specific recommendations for buying amounts of one or more investment funds to a trade execution computer which automatically performs the necessary transactions to execute the buy/sell recommendations.

30. A computer program product including at least one computer readable medium having computer program logic recorded thereon for automating investment planning for a client, the at least one computer readable medium comprising:



(a) means for inputting into a computer data regarding the client's current asset portfolio;  
(b) means for inputting into a computer data regarding the client's desired asset allocation;

(c) means for inputting into a computer data regarding the client's preferred domain;

(d) means for automatically generating financial transaction recommendations using the data in (a)-(c) for modifying the client's current asset portfolio to reach as close as possible to the desired asset allocation and the preferred domain, the recommendations including specific recommendations for selling amounts of selected current assets and specific recommendations for buying amounts of one or more investment funds; and

(e) means for displaying the recommendations on a summary report for review by the client or the client's financial manager.

31. A computer program product according to claim 30 wherein the means for automatically generating financial transaction recommendations includes means for determining tax impacts of potential sell transactions, the recommendations being selected to minimize the tax impacts.

32. A computer program product according to claim 31 wherein the summary report includes the tax impacts of at least some of the recommendations.

33. A computer program product according to claim 31 further comprising:

(f) means for inputting into a computer data regarding the client's asset portfolio preferences, including current assets that the client wishes to hold or sell, and constraints on asset selling, wherein the means for automatically generating financial transaction recommendations uses the data regarding the client's asset portfolio preferences to automatically generate the financial transaction recommendations.

34. A computer program product according to claim 30 wherein the means for automatically generating financial transaction recommendations includes means for determining

transaction costs of potential sell transactions, the recommendations being selected to minimize the transaction costs.

35. A computer program product according to claim 34 wherein the summary report includes the transaction costs of at least some of the recommendations.

36. A computer program product according to claim 30 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and the means for automatically generating financial transaction recommendations provides a recommendation to hold the client's possibly repositionable assets if the client's new asset allocation will be within a predetermined percentage of the desired asset allocation after selling all of the client's repositionable assets.

37. A computer program product according to claim 36 wherein the predetermined percentage is about 3%.

38. A computer program product according to claim 30 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and the means for automatically generating financial transaction recommendations treats the possibly repositionable assets as non-repositionable assets when making the current asset portfolio modifications.

39. A computer program product according to claim 30 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and the means for automatically generating financial transaction recommendations provides a recommendation to sell the client's repositionable assets until the tax cost of selling equals a predetermined percentage of the client's current asset portfolio.

40. A computer program product according to claim 30 wherein the recommendations include recommendations to (i) add specific amounts of shares to currently held mutual funds, and (ii) open one or more new mutual funds and contribute specific amounts of shares to the new funds.

41. A computer program product according to claim 30 wherein the desired asset allocation is determined based upon the client's Ibbotson score.

42. A computer program product according to claim 30 wherein the means for automatically generating financial transaction recommendations includes means for developing target portfolio amounts and adjusted target portfolio amounts for each asset category in the desired asset allocation.

43. A computer program product according to claim 30 further comprising:

(f) means for inputting information regarding the client which is necessary to determine the client's desired asset allocation and the client's preferred domain; and

(g) means for automatically determining the client's desired asset allocation and the client's preferred domain and using the results as the data inputs for the means (a) and (b).

44. A computer program product including at least one computer readable medium having computer program logic recorded thereon for automating investment planning for a client, the at least one computer readable medium comprising:

(a) means for inputting into a computer data regarding the client's current asset portfolio;

(b) means for inputting into a computer data regarding the client's desired asset allocation;

(c) means for inputting into a computer data regarding the client's preferred domain;

(d) means for automatically generating financial transaction recommendations using the data in (a)-(c) for modifying the client's current asset portfolio to reach as close as possible to the desired asset allocation and the preferred domain, the recommendations including specific

recommendations for selling amounts of selected current assets and specific recommendations for buying amounts of one or more investment funds; and

(e) means for selling amounts of selected current assets or buying amounts of one or more investment funds in accordance with the specific recommendations.

45. A computer program product according to claim 44 wherein the means for automatically generating financial transaction recommendations includes means for determining tax impacts of potential sell transactions, the recommendations being selected to minimize the tax impacts.

46. A computer program product according to claim 45 wherein the summary report includes the tax impacts of at least some of the recommendations.

47. A computer program product according to claim 45 further comprising:

(f) means for inputting into a computer data regarding the client's asset portfolio preferences, including current assets that the client wishes to hold or sell, and constraints on asset selling, wherein the means for automatically generating financial transaction recommendations uses the data regarding the client's asset portfolio preferences to automatically generate the financial transaction recommendations.

48. A computer program product according to claim 44 wherein the means for automatically generating financial transaction recommendations includes means for determining transaction costs of potential sell transactions, the recommendations being selected to minimize the transaction costs.

49. A computer program product according to claim 48 wherein the summary report includes the transaction costs of at least some of the recommendations.

50. A computer program product according to claim 44 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and the means for automatically generating financial transaction recommendations provides a recommendation to hold the client's possibly repositionable assets if the client's new asset allocation will be within a predetermined percentage of the desired asset allocation after selling all of the client's repositionable assets.

51. A computer program product according to claim 50 wherein the predetermined percentage is about 3%.

52. A computer program product according to claim 44 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and the means for automatically generating financial transaction recommendations treats the possibly repositionable assets as non-repositionable assets when making the current asset portfolio modifications.

53. A computer program product according to claim 44 wherein the client's current asset portfolio includes repositionable assets, non-repositionable assets and possibly repositionable assets, and the means for automatically generating financial transaction recommendations provides a recommendation to sell the client's repositionable assets until the tax cost of selling equals a predetermined percentage of the client's current asset portfolio.

54. A computer program product according to claim 44 wherein the recommendations include recommendations to (i) add specific amounts of shares to currently held mutual funds, and (ii) open one or more new mutual funds and contribute specific amounts of shares to the new funds.

55. A computer program product according to claim 44 wherein the desired asset allocation is determined based upon the client's Ibbotson score.

56. A computer program product according to claim 44 wherein the means for automatically generating financial transaction recommendations includes means for developing target portfolio amounts and adjusted target portfolio amounts for each asset category in the desired asset allocation.

57. A computer program product according to claim 44 further comprising:

(f) means for inputting information regarding the client which is necessary to determine the client's desired asset allocation and the client's preferred domain; and

(g) means for automatically determining the client's desired asset allocation and the client's preferred domain and using the results as the data inputs for the means (a) and (b).

58. A computer program product according to claim 44 wherein the means for selling amounts of selected current assets or buying amounts of one or more investment funds in accordance with the specific recommendations is a trade execution computer which is in communication with the means for automatically generating financial transaction recommendations and which automatically performs the necessary transactions to execute the buy/sell recommendations.

## ABSTRACT OF THE DISCLOSURE

A computerized scheme automates investment planning for a client. In the scheme, data regarding the client's desired asset allocation, current asset portfolio and preferred domain are input into a computer or processor. This data are used to automatically generate financial transaction recommendations for modifying the client's current asset portfolio to reach as close as possible to the desired asset allocation and the preferred domain. The recommendations include specific recommendations for selling amounts of selected current assets and specific recommendations for buying amounts of one or more investment funds. The recommendations are displayed on a summary report for review by the client or the client's financial manager, or the recommendations are electronically communicated to a trade execution computer which automatically performs the necessary transactions to execute the buy/sell recommendations. The recommendations are selected in a manner which minimizes the tax impacts and transaction costs of potential sell transactions.

666030" 92982660

# Investment Asset Hierarchy

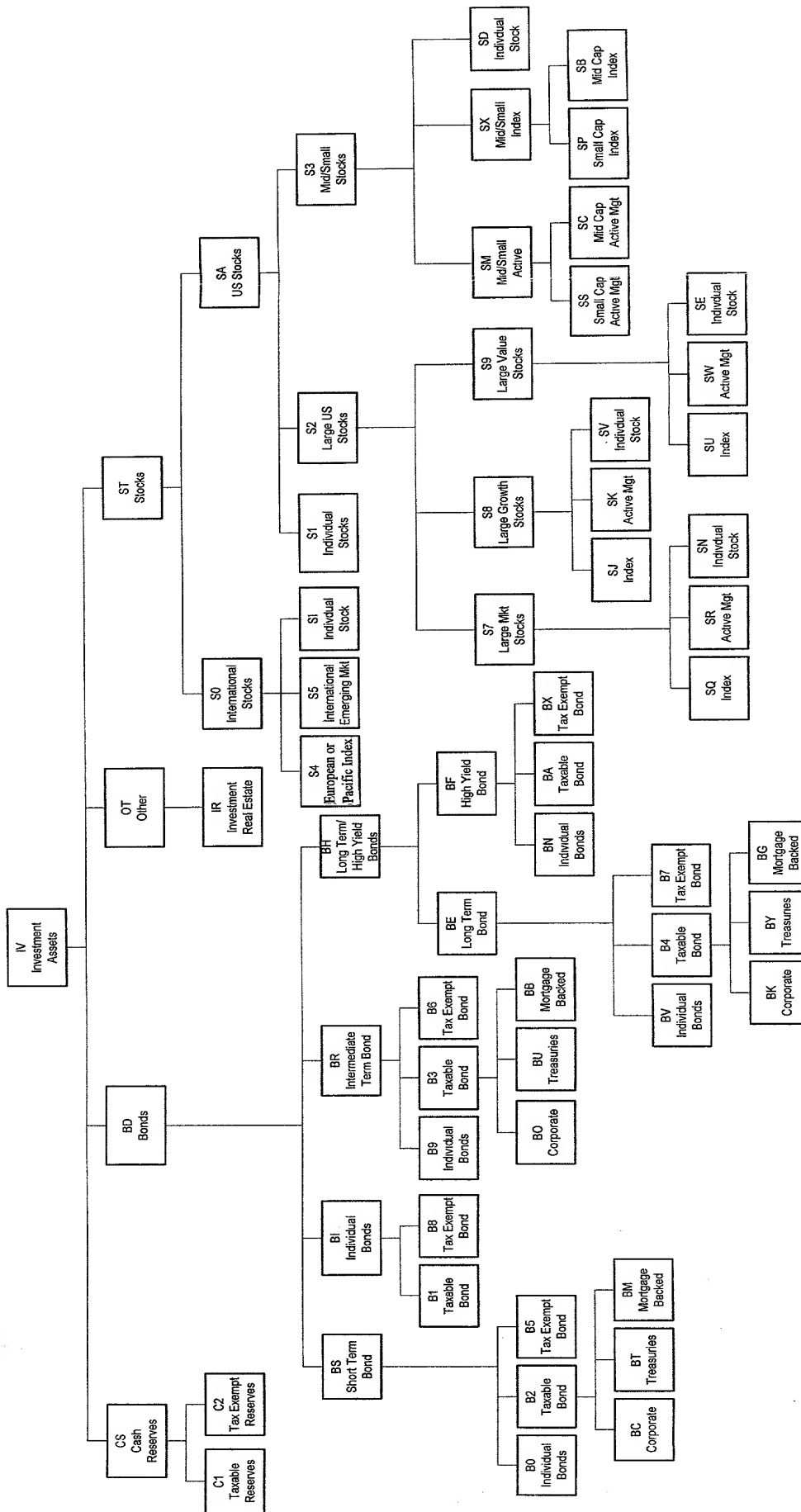


Fig. 1



## PORTFOLIO ALLOCATIONS

Portfolio	1 Tax	2 Tax	3 Tax	4 Tax	5 Tax	6 Tax	7 Tax
Cash	10%	5%					
<b>Stocks</b>							
Large Mkt Index	7%	14%	13%	16%	20%	22%	28%
Large Growth			6%	8%	10%	11%	14%
Large Value			6%	8%	11%	12%	14%
Total Large Mkt	7%	14%	25%	32%	41%	45%	56%
Mid-Small Active			5%	6%	8%	9%	12%
Mid-Small Index	3%	6%	5%	7%	9%	10%	12%
Total Mid-Small	3%	6%	10%	13%	17%	19%	24%
International Developed				4%	6%	14%	18%
International Emerging Mkts.				1%	1%	2%	2%
Total International				5%	7%	16%	20%
Total Stocks	10%	20%	35%	50%	65%	80%	100%
<b>Bonds</b>							
Short-Term							
ST Corp	58%	40%	17%	13%	10%	3%	
ST Treasury	14%	9%	6%	5%	4%	2%	
Total Short-Term Bonds	72%	49%	23%	18%	14%	5%	
Intermediate Term							
IT Corp	8%	22%	20%	13%	11%	13%	
IT Treasury		4%	5%	4%		2%	
Total Intermediate-Term Bonds	8%	26%	25%	17%	11%	15%	
Long-Term/High Yield							
Long-Term Corp			3%	2%	2%		
Long-Term Treasury			4%	3%	3%		
Total Long-Term Bonds			7%	5%	5%		
High Yield Taxable			10%	10%	5%		
Total High Yield Bonds			10%	10%	5%		
Total Long-Term/High Yield Bonds			17%	15%	10%		
Total Bonds	80%	75%	65%	50%	35%	20%	

**Fig. 2A**

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Portfolio	1 Non-Tax	2 Non-Tax	3 Non-Tax	4 Non-Tax	5 Non-Tax	6 Non-Tax
Cash						
<b>Stocks</b>						
Large Mkt Index						
Large Growth						
Large Value						
Total Large Mkt						
Mid-Small Active						
Mid-Small Index						
Total Mid-Small						
International Developed						
International Emerging Mkts.						
Total International						
Total Stocks						
<b>Bonds</b>						
ST Tax Exempt	72%	49%	23%	18%	14%	5%
Total Short-Term Bonds	72%	49%	23%	18%	14%	5%
Intermediate Term						
IT Tax Exempt	8%	26%	25%	17%	11%	15%
Total Intermediate-Term Bonds	8%	26%	25%	17%	11%	15%
Long-Term/High Yield						
Long-Term Municipal			10%	10%	5%	
Total Long-Term Bonds			10%	10%	5%	
High Yield Tax Exempt			7%	5%	5%	
Total High Yield Bonds			7%	5%	5%	
Total Long-Term/High Yield Bonds			17%	15%	10%	
Total Bonds	80%	75%	65%	50%	35%	20%

**Fig. 2B**

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PPP Questionnaire v3 U: Core Data - Mailing Address

Client: Basic, Billy

Household ID: 112326

Questionnaire No: 135591

Table of Contents

CORE DATA

1. Family Members/Mailing Address

2. Employment and Tax Information

3. Investment Assets

4. Retirement Plans

5. Non-Investment Assets

6. Stock Options

7. Life Insurance

8. Liabilities

9. Additional Core Data Information

INVESTMENT PLANNING ANALYSIS

10. Financial Objectives

11. Risk Assessment

12. Past Investment Experience

13. Additional Experience

RETIREMENT PLANNING ANALYSIS

14. Retirement Analysis

15. Current and Future Income

16. Current and Future Pension Income

17. Expenses (page 1)

18. Expenses (page 2)

19. Extraordinary Expenses

20. Education Expenses

21. Additional Retirement Information

ESTATE PLANNING ANALYSIS

22. Estate Planning

23. Current and Future Pension Income

24. Additional Estate Information

1. Family Members

Last Name	First Name	MI	Birth Date	Social Security #	US Citizen?	Gender	State	Relationship
Basic	Billy			123-37-2987	<input type="checkbox"/>	M	PA	Primary

2. Mailing Address

Name

Address

Line 2

Line 3

Line 4

City

Country

Billy Basic

123 Haddon Ave.

Haddonfield

State: NJ

Zip: 08009

Postal Code

Phone

(609) 555-1212

Phone

☐ Home

☐ Business

Fast Number

Email Address

Foreign Phone

Foreign Fax

3. Marital Status

☒ Single

☐ Married

Fig. 3A

PPP Questionnaire v3.0: Core Data: Employment and Tax Information

Client: Rehab, Michael  
Household ID: 112434  
Questionnaire No: 04201

**Table of Contents**

**CORE DATA**

1. Family Members/Mailing Address
2. Employment and Tax Information
3. Investment Assets
4. Retirement Plans
5. Non-Investment Assets
6. Stock Options
7. Life Insurance
8. Liabilities
9. Additional Core Data Information
10. INVESTMENT PLANNING ANALYSIS
11. Financial Objectives
12. Risk Assessment
13. Past Investment Experience
14. RETIREMENT PLANNING ANALYSIS
15. Retirement Analysis
16. Current and Future Income
17. Expenses (page 1)
18. Expenses (page 2)
19. Extraordinary Expenses
20. Education Expenses
21. Additional Retirement Information
22. ESTATE PLANNING ANALYSIS
23. Estate Planning (page 2)
24. Current and Future Pension Income
25. Additional Estate Information

**1. Work Status**

	Client A	Client B
Check if retired:	<input type="checkbox"/> Client A is Retired	<input type="checkbox"/> Client B is Retired
Work Status:	Full-Time	
Occupation:	Worker	
Employer:	Work Inc	
Change in work status anticipated:	<input type="checkbox"/> Change in Client A Anticipated	<input type="checkbox"/> Change in Client B Anticipated
Explain:		

**2. Income Tax**

	Joint	Client A	Client B
Adjusted Gross Income:	\$450,000		
Taxable Income:	\$425,000		
Federal Tax Liability:	\$147,000		
State Income Tax Liability:	\$34,000		
Local Income Tax Liability:	\$4,250		
Effective Tax Rate:			
Marginal Tax Rate:			

**3. Check if figures above are typical**

☐ Check if Client is an Officer

☐ Check if Client A is an officer ☐ Client B is an officer

Current Year Gain: \$0

Carry Forward Loss: \$0

Fig. 3B







Client: Rebel, Michael  
Household ID: 112934

Questionnaire No: 04201

Table of Contents

CORE DATA

1. Family Members/Mailing Address
2. Employment and Tax Information
3. Investment Assets
4. Retirement Plans
5. Non-Investment Assets
6. Stock Options
7. Life Insurance
8. Liabilities
9. Additional Core Data Information
- INVESTMENT PLANNING ANALYSIS
10. Financial Objectives
11. Risk Assessment
12. Past Investment Experience
13. Additional Experience
- RETIREMENT PLANNING ANALYSIS
14. Retirement Analysis
15. Current and Future Income
16. Current and Future Pension Income
17. Expenses (page 1)
18. Expenses (page 2)
19. Extraordinary Expenses
20. Education Expenses
21. Additional Retirement Information
- ESTATE PLANNING ANALYSIS
22. Estate Planning
23. Estate Planning (page 2)
24. Current and Future Pension Income
25. Additional Estate Information

Level of Satisfaction with the Investment

Level of Previous Investment Experience

Short-term assets:

None ☐ Low ☐ Med ☒ High

☐ V Low ☐ Low ☐ Med ☒ High ☐ V High ☐ N/A

US Govt/Corp Bonds:

None ☐ Low ☐ Med ☐ High

☐ V Low ☐ Low ☐ Med ☒ High ☐ V High ☐ N/A

High Yield/Junk Bonds:

None ☐ Low ☐ Med ☒ High

☐ V Low ☐ Low ☐ Med ☒ High ☐ V High ☐ N/A

US Large-Cap Stocks:

None ☐ Low ☐ Med ☒ High

☐ V Low ☐ Low ☐ Med ☒ High ☐ V High ☐ N/A

US Small-Cap Stocks:

None ☐ Low ☐ Med ☒ High

☐ V Low ☐ Low ☐ Med ☒ High ☐ V High ☐ N/A

Foreign Stocks/Bonds:

None ☐ Low ☐ Med ☒ High

☐ V Low ☐ Low ☐ Med ☒ High ☐ V High ☐ N/A

Ibbotson

SAA:

Model Ends:

Current SAA:

Calculate SAA

Ibbotson Score:

Preferred SAA:

Run Ibbotson Report...

SAA

Percentage

Amount

Bonds

Cash

Stocks

1

2

3

4

5

6

7

Min

Max

23

31

32

39

40

50

58

59

68

75

0.00%

6.00%

94.00%

\$0

\$50,000

\$736,600

Investment Stage

☒ Income

☐ Accumulation

Annual Income Needed:

\$0

Portfolio Til:

☒ Core

☐ Income

☐ Tax Efficient

Fig. 3E

Analysis for Invest

Client Data

Desktop System

Distributed System

Common

Ka Requested:

Apr 6, 1998

Questionnaire Received:

Apr 6, 1998

Questionnaire Last Modified:

November 4, 1998 3:26 P

Counselor Assigned:

Auto Rebalancing

☒ Save Spreadsheets
 ☒ Format Report

Show Intermediate Screen

Choose Service

Retirement...

Estate...

Investment...

XPAS...

Path:

Questionnaire Notes:

Questionnaire record automatically creat

Close

Fig. 4



# Target Allocation

Vanguard Funds			Enter Fund ID:
ID	Name	Class	
19	Vanguard Admiral Intermediate-Term	B3	
20	Vanguard Admiral Long-Term U.S. Tr	B4	
12	Vanguard Admiral Short-Term U.S. Tr	B2	
11	Vanguard Admiral U.S. Treasury M	C1	
78	Vanguard Asset Allocation	BL	
2	Vanguard Balanced Index	BL	
314	Vanguard Bond Index - Intermediate	B3	
522	Vanguard Bond Index - Long-Term	B4	
132	Vanguard Bond Index - Short-Term	B2	
84	Vanguard Bond Index - Total Bond	B3	
100	Vanguard CA Tax-Free - Insured Int	B6	
75	Vanguard CA Tax-Free - Insured Lor	B7	
62	Vanguard CA Tax-Free - Money Mar	C2	
82	Vanguard Convertible Securities	S9	
528	Vanguard Employee Index	S7	
65	Vanguard Equity Income	S9	
24	Vanguard Explorer	S3	
36	Vanguard GNMA	B4	
29	Vanguard High Yield Corporate	B4	
71	Vanguard Intermediate-Term Corpor	B3	

## Get Recommended Funds

- ☐ Show Taxable Bonds  
☐ Show Exempt Bonds  
☒ Show Both

Get Funds

☒ Use Auto Rebalancing

Auto Rebalancing

Manual Rebalancing

Show Current Assets

## Selected Funds

ID	Name	Amount	Plan/Owner
26	Vanguard Morgan Growth Fnd	\$15,000.00	Sam
78	Vanguard Asset Allocation Fnd	\$0.00	Sam
103	Vanguard Tax-Managed Fund	\$10,000.00	Sam - 401(k)
115	Vanguard Horizon Fund Globl	\$0.00	Sam
129	Vanguard Horizon Fund Globl	\$100,000.00	Marge - IRA

Client SAA: 4

Preferred SAA: 4

Total Allocated:

\$95,000.00

OK

Cancel

Fig. 5

## Current and Proposed Investment Portfolio

Item	Asset Class	Owner	Tax Status	Current Total	Current Total %	Suggested Change (\$/)	Proposed Total	Proposed Total %	Target Total %	Base
<b>Cash Reserves</b>	CS									
Stock/Cash Bal (50% Cash)	CS	Sam	Taxable	\$20,000.00						\$0.00
Vanguard Money Market - Prime	CS	Marge	Taxable	\$50,000.00						\$0.00
Vanguard Money Market - Prime	CS	Marge	Taxable	\$40,000.00						\$0.00
Vanguard Horizon - Global Asset Allocation (22%)	CS	Sam	Taxable	\$22,000.00						\$0.00
Vanguard Asset Allocation (20%)	CS	Sam	Taxable	\$20,000.00						\$0.00
Vanguard Asset Allocation (20%)	CS	Sam	Taxable			\$0.00	\$0.00			\$0.00
Vanguard Horizon - Global Asset Allocation (22%)	CS	Sam	Taxable			\$0.00	\$0.00			\$0.00
Total - Cash Reserves	CS			\$192,000.00	9.14%		\$0.00	0.00%	0.00%	
Total - Cash Reserves				\$192,000.00	9.14%		\$0.00	0.00%	0.00%	
<b>Bonds</b>	BI									
Individual Bond	BI									
Bonds	BI	Marge	Taxable	\$100,000.00						\$0.00
Stock/Bond Bal (50% Bonds)	BI	Sam	Taxable	\$50,000.00						\$0.00
Total - Individual Bond	BI			\$150,000.00	7.14%		\$0.00	0.00%	0.00%	

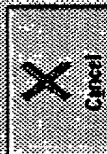
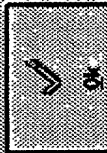
All column totals are currently accurate.

## Balanced Funds

Item	Owner	Current Total	Suggested Change (%)	Proposed Total
CRF - Bond Market	Sam	\$100,000.00	\$0.00	\$0.00
CRF - Equity Index	Sam	\$100,000.00	\$0.00	\$0.00
CRF - Global Equities	Sam	\$100,000.00	\$0.00	\$0.00
CRF - Growth	Sam	\$100,000.00	\$0.00	\$0.00

### Legend

Current Asset*	Subasset Class/Total	Grand Total
Proposed Assets	Asset Class/Total	Deleted Line Item



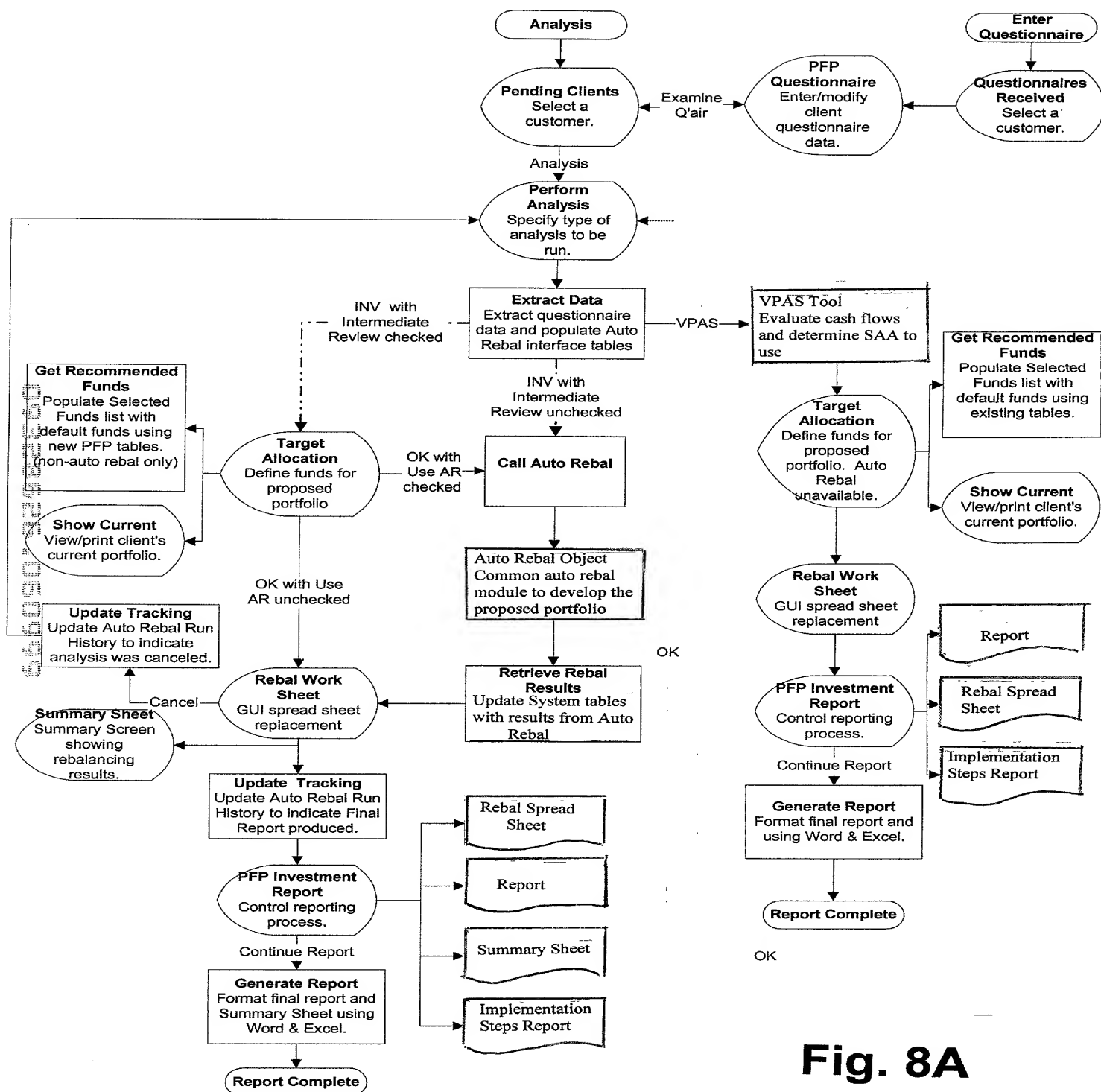
**Fig. 6**

## PORTFOLIO ALLOCATIONS

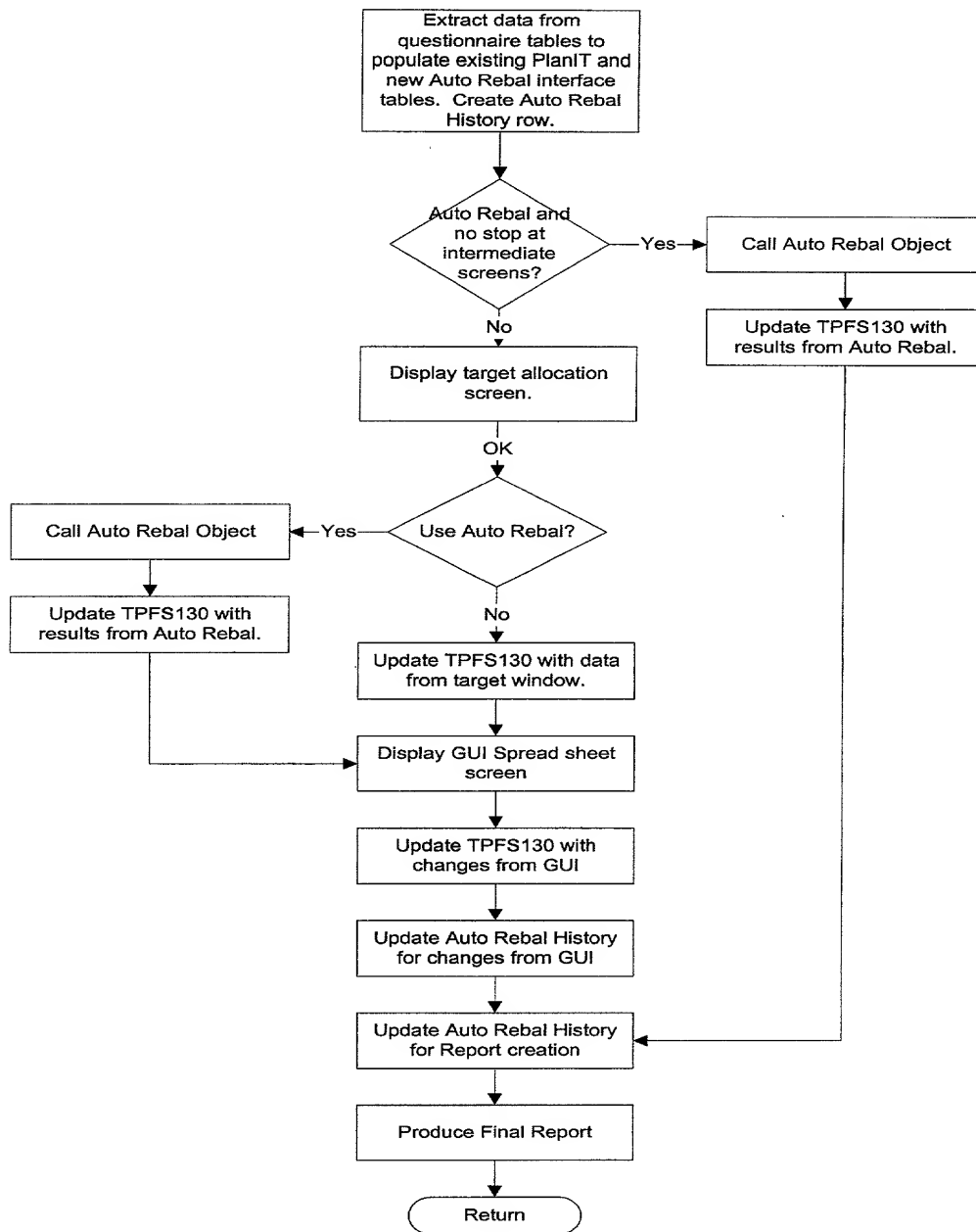
PORTFOLIO	1	2	3	4	5	6	7
<b>BONDS</b>	<b>80%</b>	<b>75%</b>	<b>65%</b>	<b>50%</b>	<b>35%</b>	<b>20%</b>	<b>0%</b>
High Yield*	0%	0%	10%	10%	5%	0%	0%
Long-Term*	0%	0%	7%	5%	5%	0%	0%
Intermediate-Term Index	0%	8%	10%	8%	0%	4%	0%
Intermediate-Term Active	8%	18%	15%	9%	11%	11%	0%
Short-Term Index	24%	15%	10%	8%	7%	4%	0%
Short-Term Active	48%	34%	13%	10%	7%	1%	0%
<b>STOCKS</b>	<b>10%</b>	<b>20%</b>	<b>35%</b>	<b>50%</b>	<b>65%</b>	<b>80%</b>	<b>100%</b>
Large Market/Index	7%	14%	12%	16%	20%	22%	28%
Large Growth	0%	0%	6%	8%	10%	11%	14%
Large Value	0%	0%	6%	8%	11%	12%	14%
Mid/Small Market/Index	3%	6%	6%	6%	8%	10%	12%
Mid Active	0%	0%	2%	3%	4%	4%	6%
Small Active	0%	0%	3%	4%	5%	5%	6%
International-Developed	0%	0%	0%	4%	6%	13%	16%
International-Emerging	0%	0%	0%	1%	1%	3%	4%

\* When using Municipal Bonds for portfolios 3 and 4, percentages are flipped for long-term and high-yield bonds. For portfolio 5 use 4% high-yield and 6% long-term municipal bond.

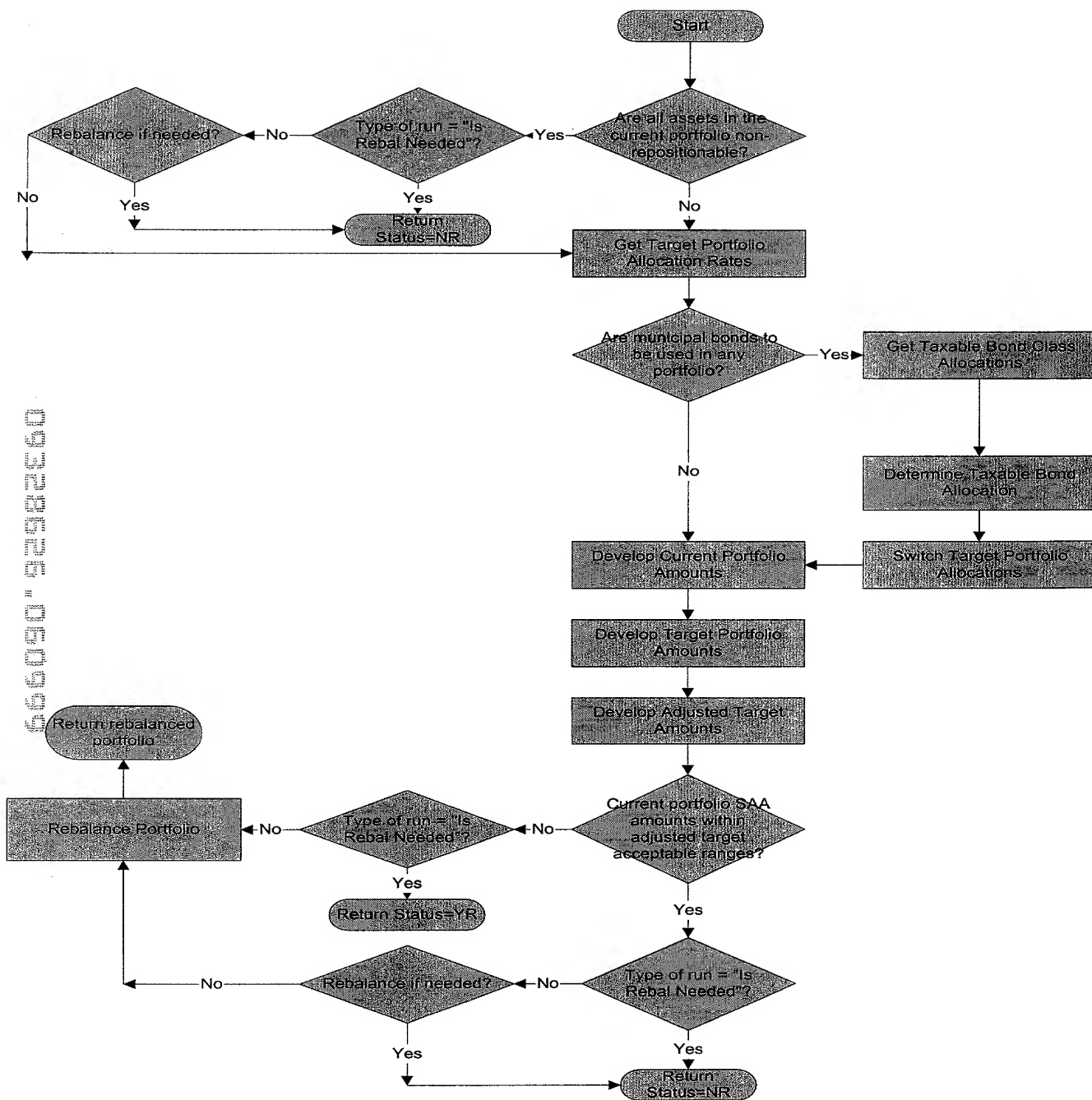
**Fig. 7**



032825 060999 66090 928266

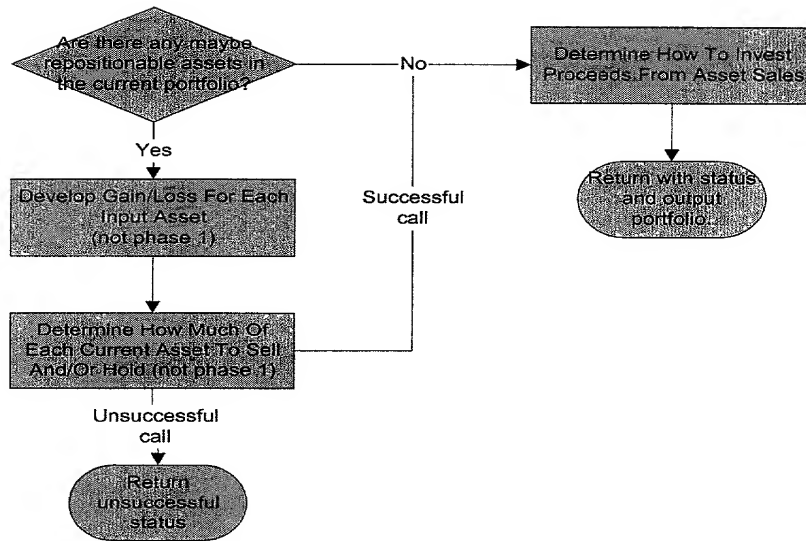


**Fig. 8B**



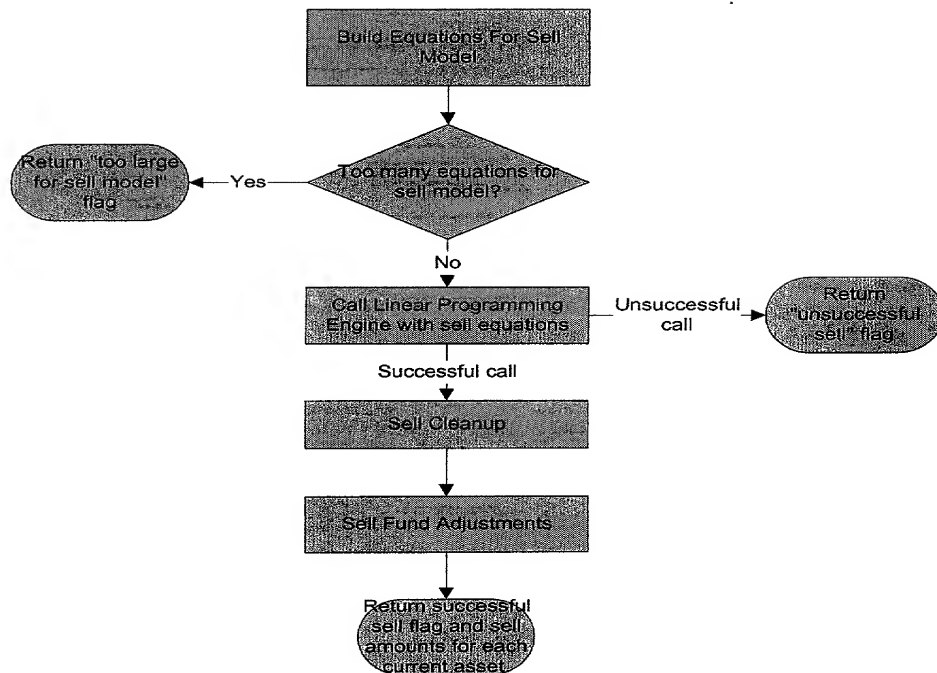
**Fig. 8C**

09328626 050999  
666090" 92982E60



**Fig. 8D**

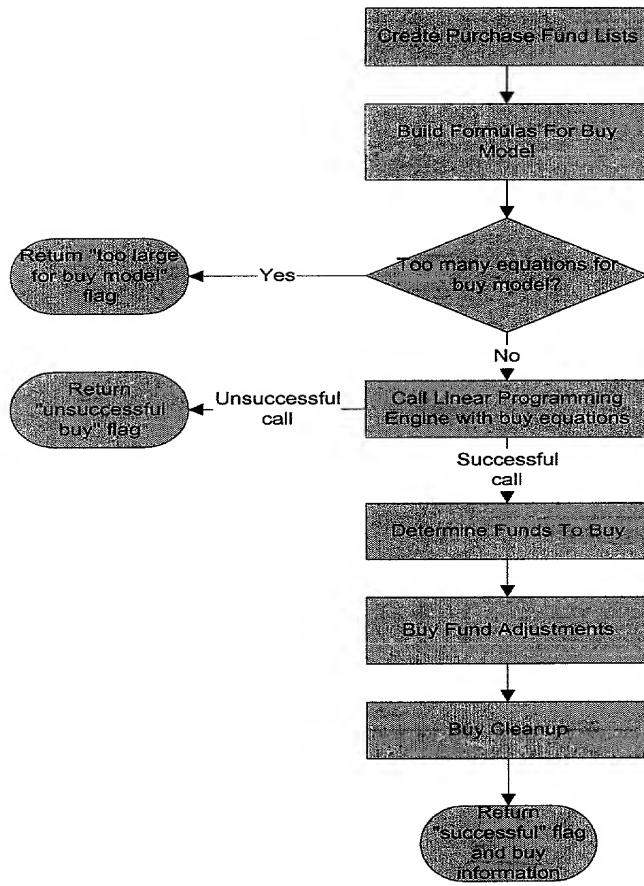
032826 060999  
666090 92982660



**Fig. 8E**



09328626 060999



**Fig. 8F**

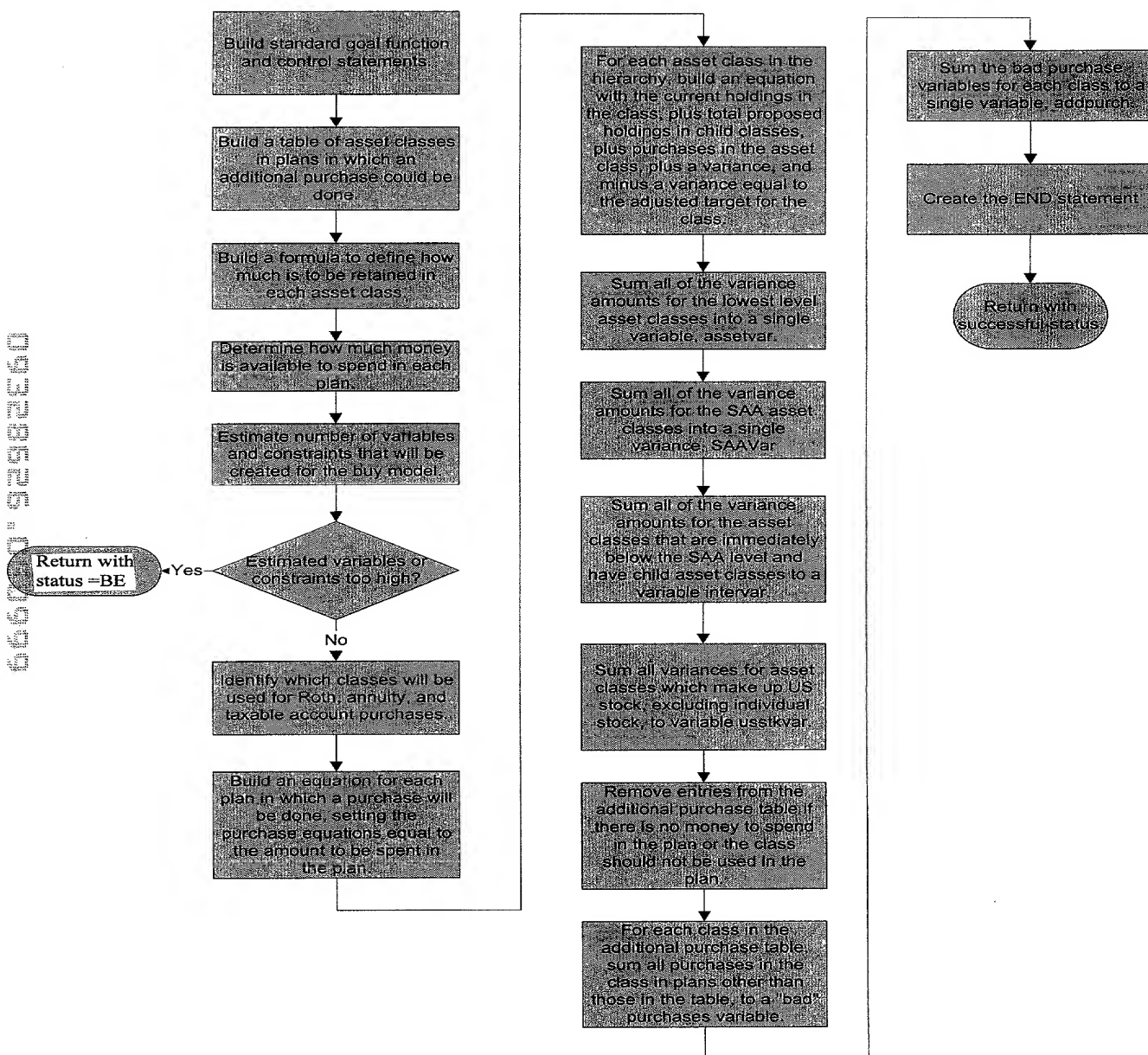


Fig. 8G

09328626 050999

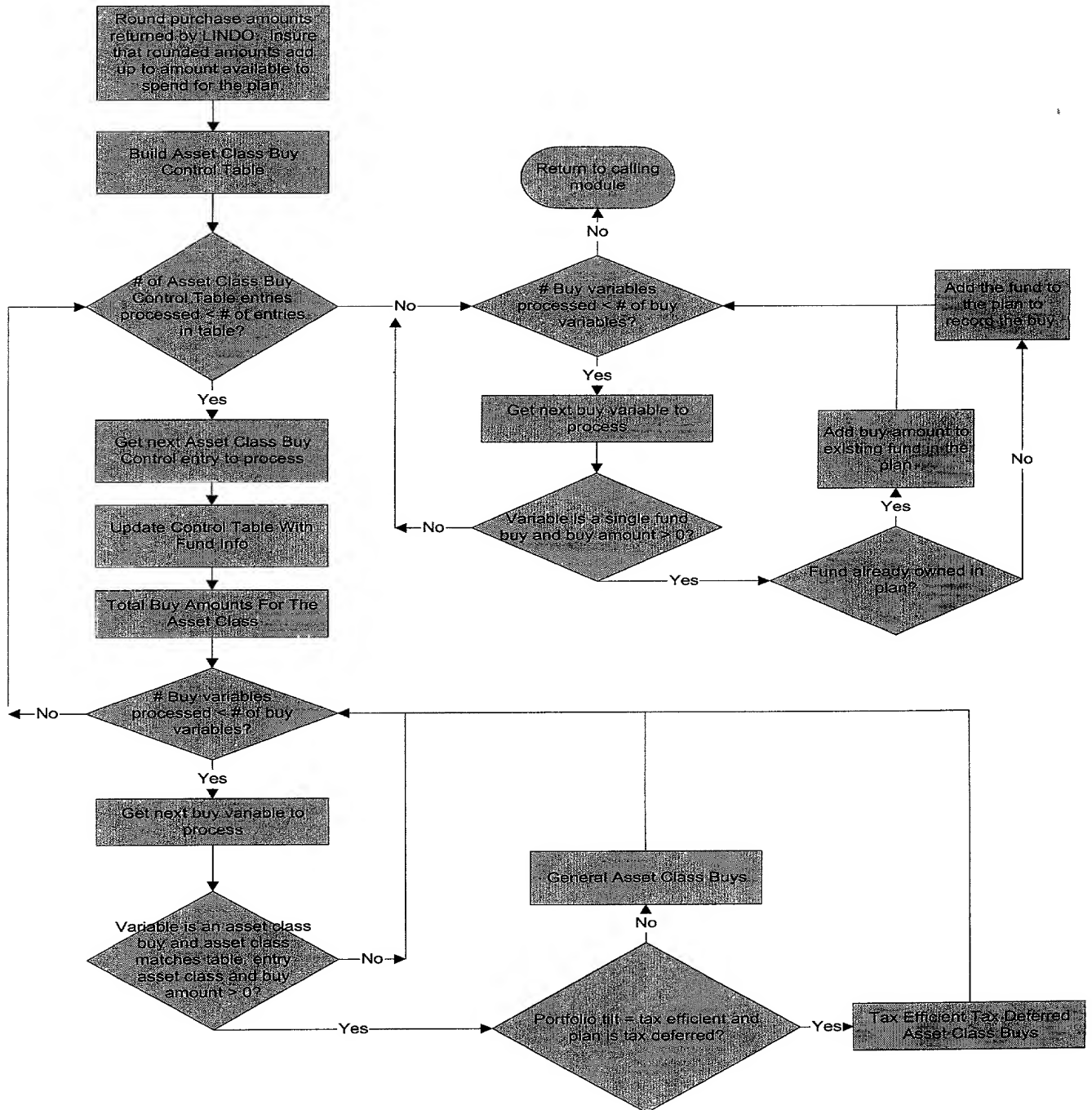
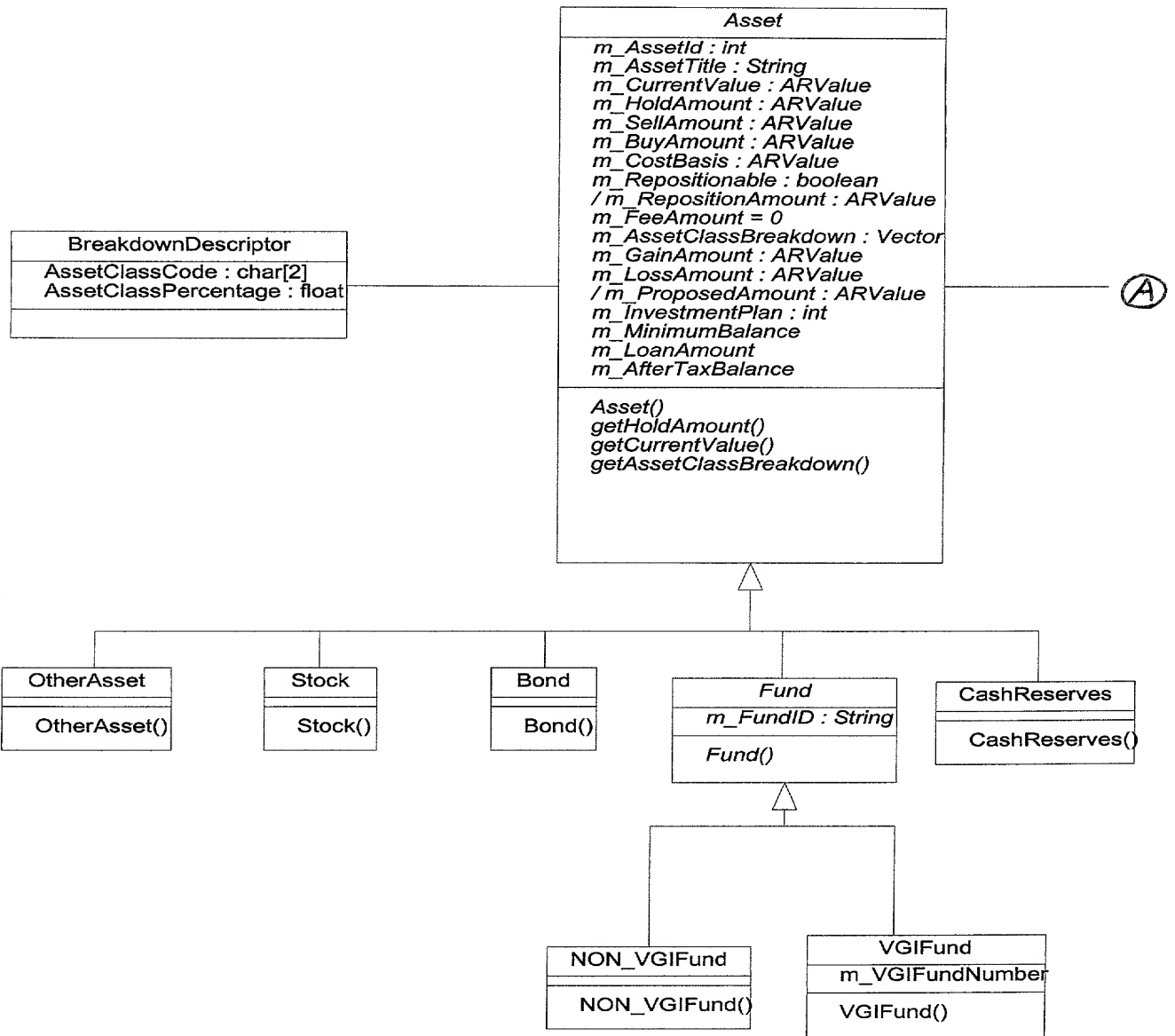
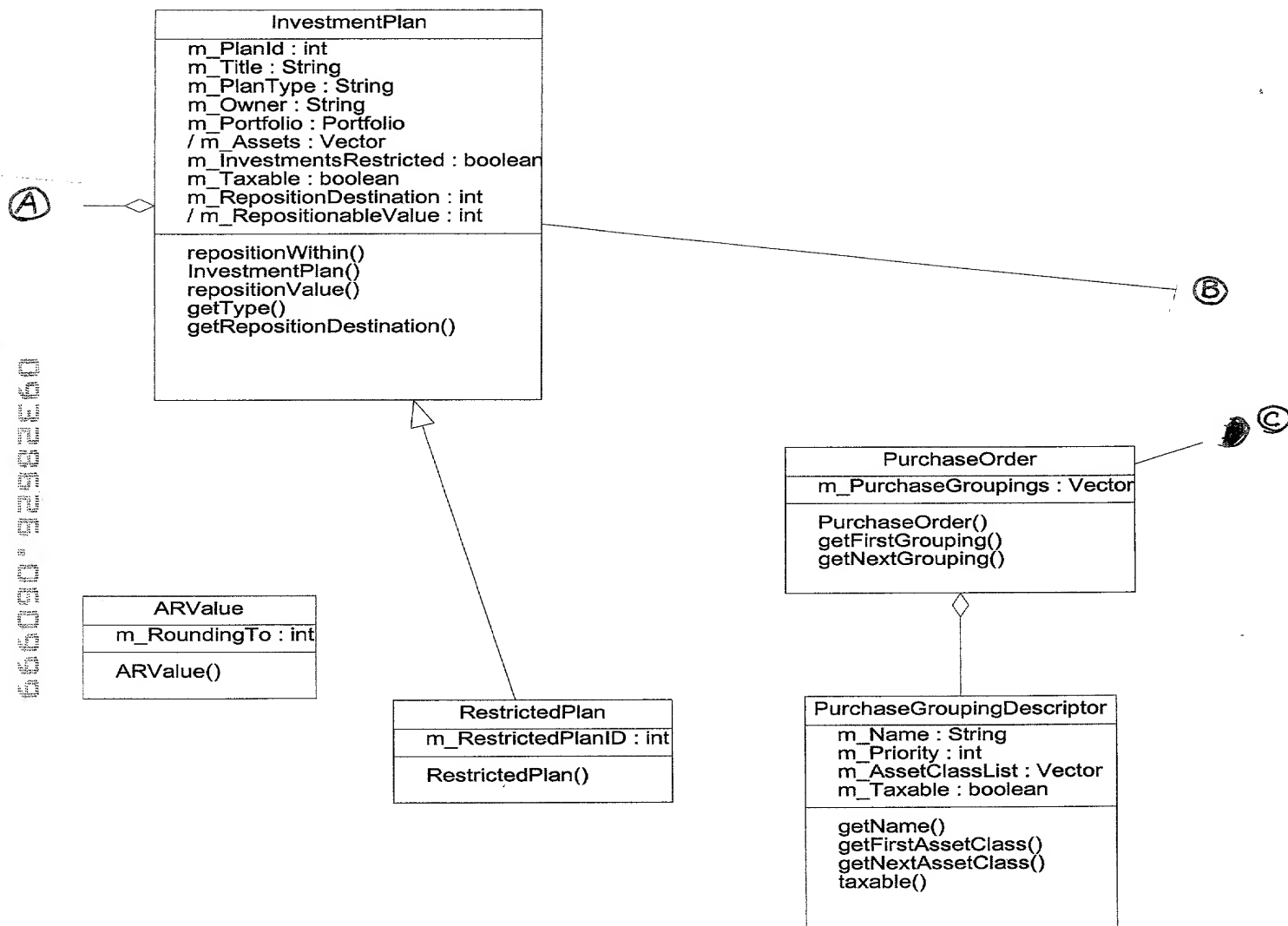


Fig. 8H



**Fig. 9A**

0932866.060999  
666090 9288660



**Fig. 9B**

0930626.030999  
666090.9298560

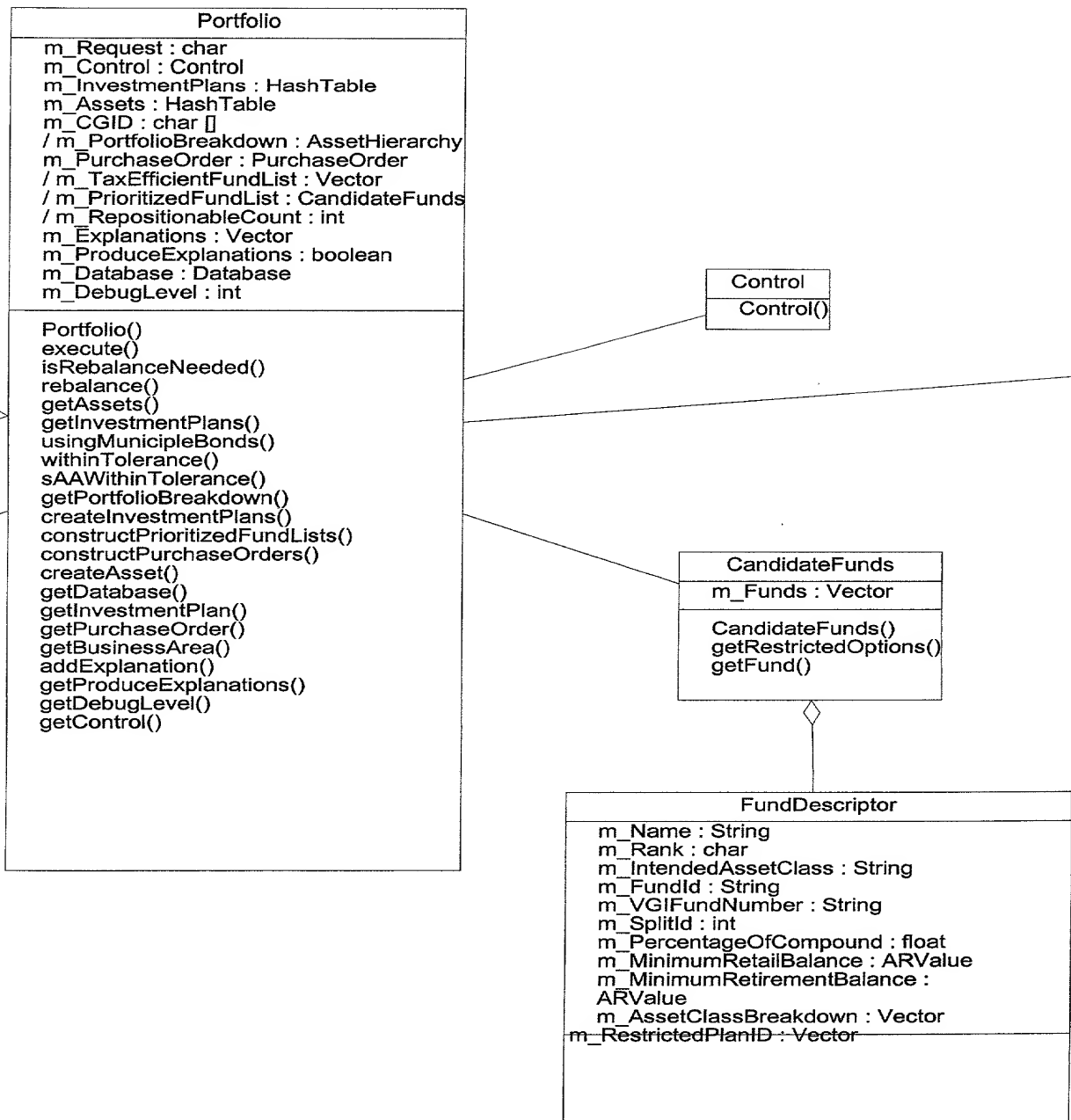
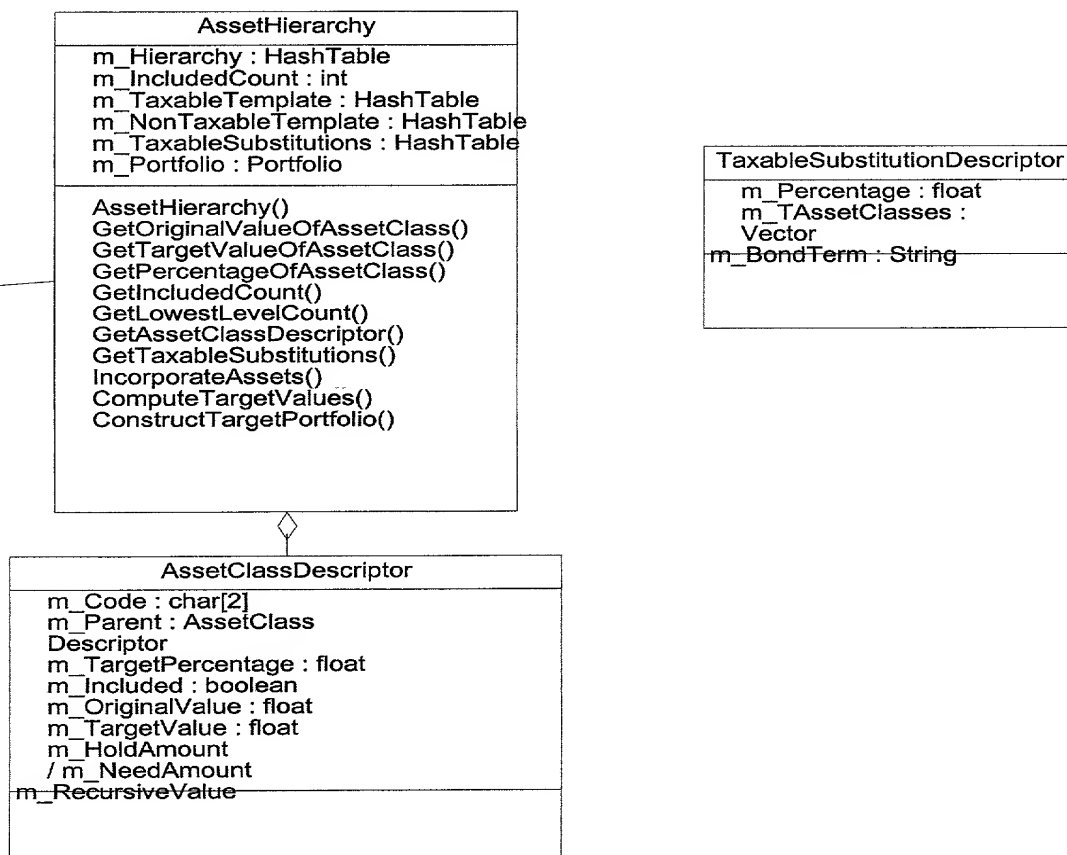


Fig. 9C

©

0938326099 66090" 92982660



**Fig. 9D**

09323626 060999

Control
m_PreferredDomain : char[2] m_MuniForInterTermBonds : boolean m_MinRetirementFundBalance : ARValue m_MuniForShortTermBonds : boolean m_MuniForLongTermBonds : boolean m_MuniForHighYield : boolean m_ProduceExplanations : boolean m_BusinessArea : char[4] m_MinRetailFundBalance : ARValue m_MinTransactionAmt : ARValue m_TSMPToleranceBelow m_TSMPToleranceAbove m_TIPToleranceBelow m_TIPToleranceAbove m_CarryForwardLoss : ARValue m_CurrentYearGains : ARValue m_RoundingTo : int m_EstimateTaxCostAssetPct m_EstimateTaxCost : boolean m_SAAVarianceAbove m_SAAVarianceBelow m_CapGainTaxRate m_LegalResidenceState : char m_TaxExemptDCAFund m_PortfolioNumber : int m_TacticalShift m_PortfolioTilt m_TaxAcctDCAFund m_MaxAssetConstraints m_MaxAssetVariable m_RequiredVariables m_RequiredConstraints
Control()

Fig. 9E



666090" 92937E50

Database.
\$ m_LastFundID : String
getControlVariables() getPurchaseOrder() getTargetTemplate() getAssetHierarchy() getAssets() getEquivalentAssets() getAllInvestmentPlans() connect() disconnect() searchAsset() updateBreakdown() searchInvestment() updateInvestmentChoices() getCandidateFunds()

InvestmentPlanData
getPlanId() getTitle() getPlanType() getOwner() getInvestmentsRestrictedFlag() getTaxFlag() getRepositionDestination() getRestrictedPlanId() getRestrictedPlanChoices()

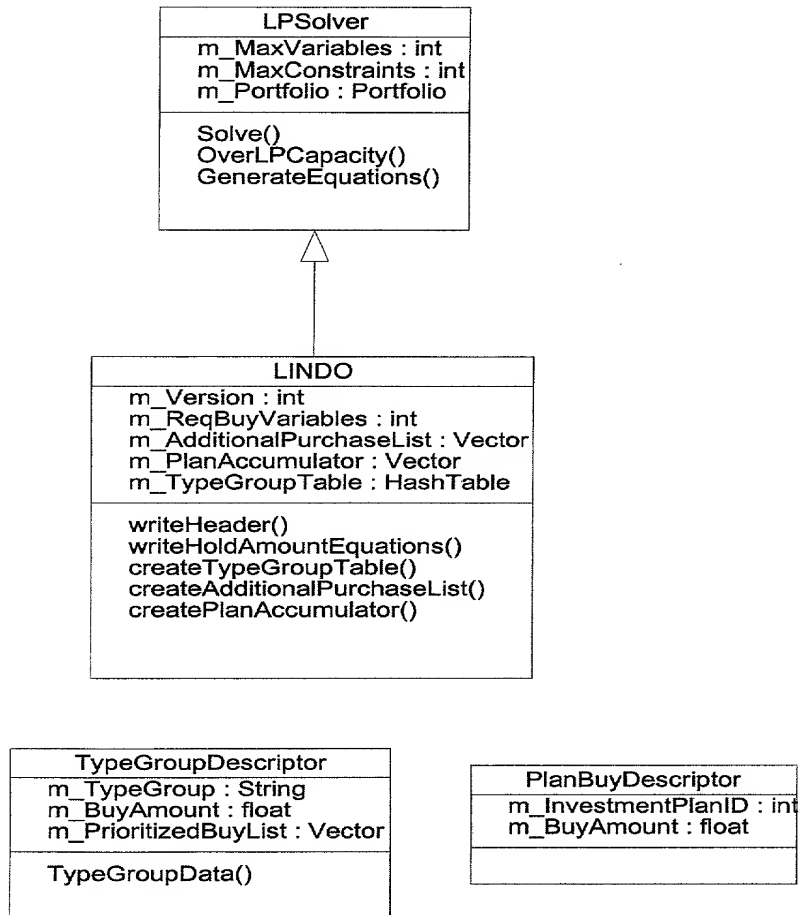
AssetData
getAssetId() getAssetTitle() getCurrentValue() getHoldAmount() getMinimumBalance() getCostBasis() getRepositionIndicator() getFundID() getVanguardFundFlag() getCostBasisFlag() getInvestmentPlanNumber() getAssetClassBreakdown() getVendor() getVGIFundNumber() getAfterTaxBalance() getLoanAmount() getBuyAmount() getSellAmount() getProposedAmount()

AssetHierarchyData
getAssetClass() getParent() getIncluded()

PurchasePreferenceData
getGrouping() getSequenceNumber() getAssetClassCode() taxable()

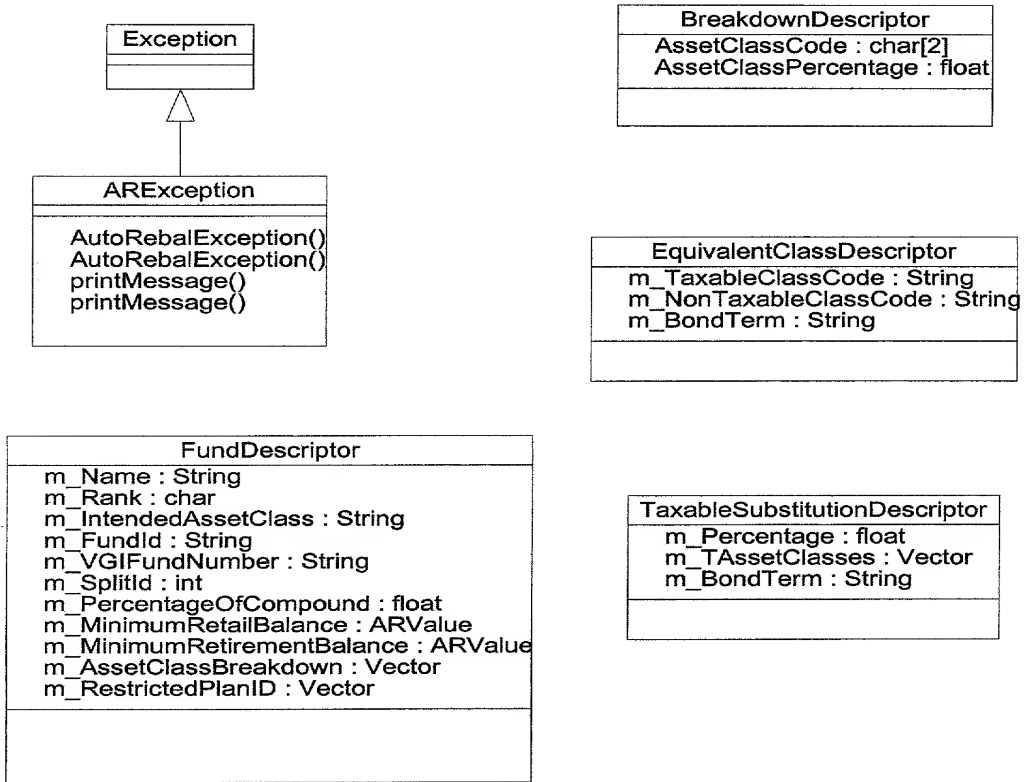
Fig. 9F

09328626 060999 666090" 92982660



**Fig. 9G**

032366 060999 666099 92982650



**Fig. 9H**

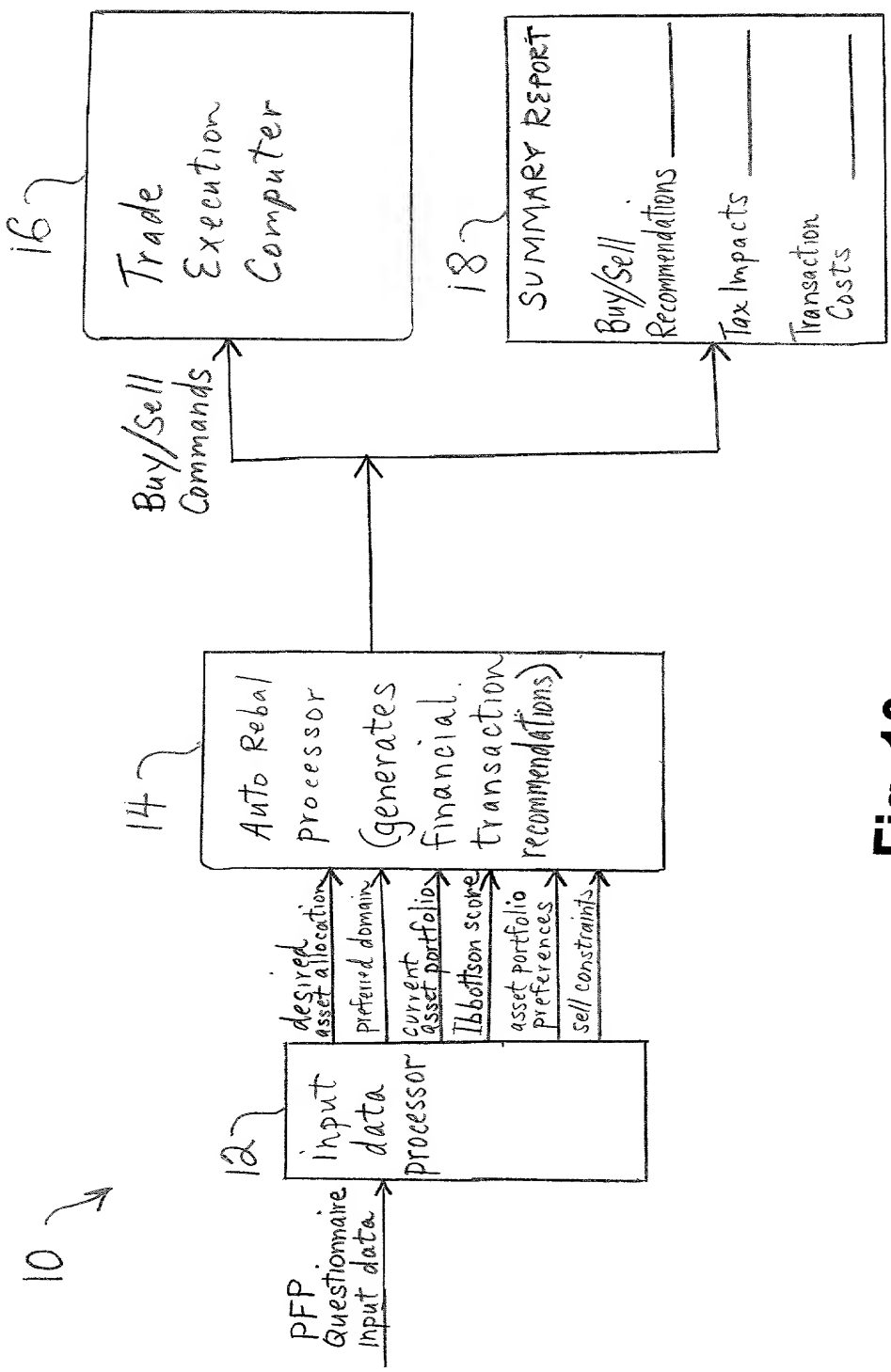


Fig. 10

**DECLARATION AND POWER OF ATTORNEY**  
(Original Application)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**SYSTEM AND METHOD FOR AUTOMATING INVESTMENT PLANNING**  
the specification of which is attached hereto and/or was filed on Herewith as Application No. \_\_\_\_\_.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to herein.

I acknowledge the duty to disclose information which is material to patentability in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

**FOREIGN PRIORITY APPLICATION(S)**

<u>None</u>		
(Number)	(Country)	(Day/month/year filed)
<hr/>		
(Number)	(Country)	(Day/month/year filed)

**Priority Claimed**

☐ Yes ☐ No

☐ Yes ☐ No

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional patent application(s) listed below and have also identified below any United States provisional patent application(s) having a filing date before that of the application on which priority is claimed:

**PROVISIONAL PRIORITY PATENT APPLICATION(S)**

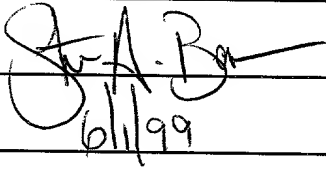
		<b><u>Priority Claimed</u></b>
None		<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	
(Application No.)	(Filing Date)	
_____		<input type="checkbox"/> Yes <input type="checkbox"/> No
(Application No.)	(Filing Date)	

And I hereby appoint the registered attorneys and agents associated with **Panitch Schwarze Jacobs & Nadel, P.C., Customer No. 000570**, as my attorneys or agents with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Address all correspondence to **Customer No. 000570, namely, PANITCH SCHWARZE JACOBS & NADEL, P.C.**, One Commerce Square, 2005 Market Street, 22nd Floor, Philadelphia, Pennsylvania 19103-7086. Please direct all communications and telephone calls to **Clark A. Jablon** at 215-965-1293.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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